A

TREATISE

ON THE

CULTURE OF WHEAT,

RECOMMENDING

A SYSTEM OF MANAGEMENT

FOUNDED UPON

THE SUCCESSFUL EXPERIENCE

OF

THE AUTHOR.

BY A PRACTICAL FARMER.

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DEDICATION.

TO

GEORGE FREDERIC STRATTON, Esq.

GREAT TEW PARK, OXFORDSHIRE.

Sir,

The elegant and accomplished Poet Horace, when seeking immortality from his writings, solicited for them the approbation of Mecænas alone, whose single judgment in their favour he considered sufficient to stamp them with the seal of excellence; so much in the estimation of this polite and charming poet, was the opinion of a man of taste to be preferred to the indiscriminating voice of the multitude.

To you, Sir, who feel particularly interested in every circumstance connected with the national

welfare, I beg leave to present this Treatise on the Culture of Wheat; and should it appear in your opinion entitled to any portion of merit, my anxiety about its reception by the public will be set at rest.

I have the honour to be,

Sir,

Most respectfully,

Your obedient and humble Servant,

THE AUTHOR.

AUGUST, 1812.

INTRODUCTION.

AS the object of the following pages is to introduce to public notice an improved method of cultivating wheat, I have purposely avoided mixing with my subject, the question of tythes, or the policy of cultivating waste lands. The evil of which the nation at present complains is urgent and pressing, and therefore requires an *immediate* remedy, which could not be found in the abolition of tythes, or the inclosing and improving uncultivated commons. The benefits of either could only operate at a remote period. The improvements I propose can be carried into effect directly, and the good consequences be felt

the very next year. They interfere with no interest; they entrench upon no establishment; they require the employment of no additional capital; the means of pursuing them are in the hands of every farmer; no branch of the revenue will be violated by this operation. The necessity which has been admitted by all writers on our national resources, to exist, and, indeed, to have existed for many years past, for an increase in our growth of corn, particularly wheat, added to the frequent recurrence of high prices; would lead the man of reflection to suppose that he who could point out an improvement of such consequence as I have attempted, must be received with kindness by the public, and his labours properly appreciated. Were a deficiency in the growth of wheat, or a failing crop to happen but seldom, we might view the occurrence with diminished apprehension; but unfortunately the youngest man living has witnessed them repeatedly; and unless the public attention shall be awakened to the situation

of the country, with respect to the growth of corn, the consequences may prove fatal to our very existence.

In speaking of the necessity for improvement in our cultivation of corn, I must be understood as not confining myself to barely supplying our internal wants. A country which bounds its views of agriculture with the selfish end of mere subsistence is exposed to constant danger of scarcity; therefore, in order to ensure a proper exertion of industry and skill on the part of the farmers, agriculture ought to be considered as a commercial pursuit, and by opening foreign markets to their view, stimulate them to enlarged cultivation.

The high price of grain in the home markets operates at present as a bounty to foreign farmers, and as we are certainly not an exporting people (of grain,) British farmers, British landlords, and

the British public, are deprived of the benefits which would result from the improved and extended cultivation of British lands. We well know how the nation suffers by the high price of provisions, independent of the actual cost of them to individuals. The army, the navy, the increased expenditure in both in all public contracts, the poor's rates, deficiency in the revenue, and many other contingencies, are matters of serious import. Exclusive of the money paid to foreigners for corn, and bounty paid by the legislature for its importation, foreign freight, foreign shipping, &c. &c. the exportation of corn from this kingdom, amongst many other incalculable benefits, would occupy such a proportion of British shipping and British sailors as would render it a national object. It would trim the balance of trade and turn the scale finally in our favour. It would afford employment to an increasing population, raise the revenue, and reduce the poor's rates. The prosperity of the

empire is so involved in the measure, that I should consider apathy in the present critical period as a dereliction of public duty deserving the punishment of the ostracism.

It has frequently been matter of astonishment to me, that the attention of our legislature has not been more alive to the export of corn and improvement of agriculture, which may truly be considered the most important description of commerce, the surest basis of revenue, riches, and national prosperity.

I have endeavoured to lay before the reader information on the improvement of wheat culture, which, however simple it may appear on perusal, has only been collected at the expense of much time and trouble, and the value of which will be best estimated by its effects when properly put in practice.

Should the period arrive when wheat shall take place of oats and barley through the kingdom, an event I can easily foresee, the condition of the working classes must be improved in a very great measure. This improvement I have endeavoured to point out.

There are, however, many great and important measures attached to the subject of the following Work, which will occur to the intelligent reader without my introducing them here: that of the permanent increase in our finances without burthening the people may be considered as of no minor consequence. Politicians, however, whose ideas are circumscribed by habitual and contracted views of the present system, are not likely to enter into the comprehensive prospect which opens to their consideration. It was the constant object of contemplation of a man who filled an eminent station in this country, and had he lived

would have given to it all the weight of his powerful talents.

A country which is dependant upon foreigners for bread corn can never be called truly powerful: the caprice of those on whom she relies for support, or their own crops proving deficient may be attended with consequences of a serious nature. We have a very sufficient proof this year, that no dependance ought to be placed on foreign assistance, and, indeed, in no season has there ever been a quantity of grain to be had, which, in the event of actual scarcity, would stand in the stead of our own produce; not if the whole world were ransacked for the sweepings of its granaries; it, therefore, behoves us to depend upon our own resources: as to the boasted assistance of America, she could not feed us a week.

No individual could make a more valuable present to the nation than power and capability

to supply the inhabitants with bread. This has been my object, and its full portion of success depends not upon me, but upon those who occupy the land.

In coming forward on this subject I profess myself actuated by one single motive, which it is impossible to mistake. Those who may happen to differ from me in opinion will, I hope, treat me with the same candour that is due to the question before us. Let them make trial of the plans pointed out rather than endeavour to discourage others by hazarding doubts and conjectures. I profess myself willing to assist every man who shall require assistance, or every agricultural body in the kingdom, with any further information in my power, in order to enable them to accomplish that great and vital object of growing sufficient corn for our own consumption.

I am well aware that a measure of this magni-

tude is difficult of attainment; but it is not only by no means impossible, on the contrary we really have it in our power.

The owners of great estates are imperiously called upon to lend every assistance. They are, properly speaking, trustees for the public, and, therefore, bound in duty to cause their lands to contribute, as much as can be done, to the common stock.

The idea of calling different sciences to the aid of agriculture has been, by many, considered fanciful, and practice deemed incompatible with philosophical inquiry; but

——————— Philosophy consists not

In airy schemes or idle speculation.

Thomson.

The man of superficial acquirements may confine himself to reading and talking, whilst the

true philosopher, by reducing that to practice which his acute and penetrating mind has, from intensity of thought, conceived in theory, confers a benefit on mankind, and derives a pleasure from his mental labours beyond all valuation; he

> Exults in joys to grosser minds unknown,
> A wealth exhaustless, and a world his own.

I consider agricultural philosophy to be a province as yet unexplored, upon the borders of which we have just partially trodden, without having as yet ventured far enough to partake of its beauties. As a profound and exquisitely beautiful science, I deplore the infatuation which commits it to the hands of men who can only treat it as a vulgar art.

Pretending to be wiser than our forefathers is a crime of no trifling magnitude in the eyes of many very worthy people; but education and its

consequences have made a change in the minds of men which enables us to detect many antediluvian errors, rendered in some degree sacred by immemorial usage. He who sets about to inquire into the abstruse and hidden processes of nature should never be deterred from his purpose because he may find himself at a loss to account for or explain many of her intricacies; the object he has in view will be more readily accomplished by minutely and clearly investigating to the nicety of demonstration, one or two material points, than by any loose or vague speculations in the boundless regions of fanciful theory.

It is possible that many particulars inserted in the following treatise may be considered as too trifling or diminutive in themselves to be enlarged upon in a work intended for practical purposes; but to the eye of taste and judgment nothing indicative or explanatory of those beautiful arrangements in the great laboratory of nature

should be permitted to escape observation, the most apparently inconsiderable of which is of greater consequence than all the efforts of human genius, when carried to the utmost extent of its improvements.

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CHAPTER I.

Address to the readers.—Great difficulty of investigating the process of vegetation.—Theory necessary to be understood in agricultural business.—Learning necessary to an agriculturist. — Importance of the subject in many points of view.—Various seasons require different kinds of management.—The public benefitted by the improvements in agriculture.—Causes of our backwardness in the science.—Importance attached to it by the Chinese.—Great increase of produce in wheat crops.

THE Public, for whose benefit the following treatise has been written, will be too generous to judge harshly of a work inspired by motives of the purest patriotism; nor would it be less than in-

sulting good sense and good nature to offer an apology for an *attempt* to render an essential service to the community. It is hoped there will not be any thing found contained herein, which the man of science can greatly disapprove of, unless the plainness of the style; but as it was intended for practical men who are little acquainted with terms of philosophy, I have avoided these as much as possible. As to the farmer, I shall not appeal to his opinion at first sight, but to his candid and unbiassed observation of the result, after putting it to the test of practice. The difficulty of discovering the exact connection of effects with their causes, in this important subject, is greater than in many others; because the secret processes of vegetation are so mysteriously conducted, some of them in the hours of darkness, and take up such a length of time, exposed to the various and concomitant operations and effects of the atmosphere in a climate proverbially changeable.

The difficulty of determining with precision on what peculiar circumstances the health of a plant depends, is, therefore, by no means easily overcome, and requires the unwearied application

and experience of many years, to afford a rational foundation for building a superstructure.

Theory and system are held too cheap by the generality of farmers, and from this circumstance arise most of our defects in agriculture.

Fielding has wittily and aptly remarked, "that a man *writes* nothing the worse for understanding something of his subject." The observation may be extended beyond writing. A practical farmer would, as well as a practical gardener, conduct his business with (it may be presumed) equal success if he had some idea of the connection between science and art, between causes and effects; it would at least save him from committing many blunders.

Agriculture, one of the most beautiful and amongst the most comprehensive of the seiences, is degraded by absurd custom into something below the humblest of the arts; and its management usually confided to the most illiterate and ignorant of men, unprepared by any previous education, (writing and reading in some cases excepted), who undertake to conduct a series of operations, on which the welfare of the nation materially depends, and which requires an exten-

sive acquaintance with many branches of philosophy, and most of the living as well as dead languages. "*Omnium rerum* (says Cicero) *ex quibus aliquid acquiritur, nihil est agriculturâ melius, nihil uberius, nihil dulcius, nihil homine libero dignius.*"

The necessity under which Great Britain has laboured for thirty years past, of importing a large quantity of bread corn, is admitted by all who have given any attention to the subject, and pathetically lamented by those who have written on it. The traffic is unquestionably injurious to the prosperity of the country, and when I do not go as far as some in saying, "*if continued, will eventually ruin the nation, by draining us of our wealth,*" it is because there is no propriety in admitting the eventual occurrence of that which we have the means of preventing.

How far it is injurious, may be guessed from a calculation which has been made, that upwards of one hundred millions sterling have been sent to other countries, within twelve years, for corn. A sum which ought to have been paid to our own farmers, had we been pursuing a proper system of wheat management. But leaving the nume-

rical value out of the question, it is worthy the notice of the patriot and politician, when other consequences come to be considered. France has no longer any regular commerce, and the exigencies of that power are, to a certain extent, provided from her agricultural efforts. The cultivation of the vine has been greatly curtailed since her brandies and wines have found difficulty of admission into these countries; this has diverted the efforts of her farmer to the extended growth of corn; and could we supply ourselves with bread from our own resources to the exclusion of French grain, there is little doubt but the difficulties of Buonaparte would be greatly increased when deprived of the *tribute* we at present pay him of about *four or five millions sterling*, every year, for corn: it would, perhaps, break through his famous, or rather infamous, continental system sooner than the united efforts of the whole physical and political strength of the empire. At present he refuses admission to the produce of our colonial lands, and we are absolutely unable to retaliate, from dire necessity.

For some reason or other it happens that we

are very fond of improvements recommended by foreigners. To say that a method of preventing the diseases of wheat had been discovered by a French or Italian philosopher, and rewarded by Buonaparte with the grand cross of the Legion of Honour, would ensure it a favourable reception in this country; and I very much fear the little notoriety which the Author claims for himself in this essay may be the means of preventing its circulation, although there are many in this country satisfied with the productions of its own children, and willing to admit the claims of merit wherever due.

No farmer ought to condemn any mode of management merely because he may be unacquainted with it. Very few men (perhaps I may say no one) understand all branches of husbandry. The science of agriculture, and the practice of it, cannot, for a long time, or perhaps never, be completely comprehended; therefore no individual ought to think himself removed beyond the necessity of instruction.

A practical farmer should hold in remembrance, that a *system,* or determined mode of management, which has succeeded on one farm, would,

in all probability, be found defective on another, from some very obscure and unnoticed cause.

The operations of a farmer must consequently, to be well conducted, be guided by an attentive consideration of contingent and adventitious circumstances, differing materially in different years. And when I hear a man, who has derived his routine of management from some spot where he has lived the chief part of his life, pointing out the same as applicable to soil and climate differing in a very material degree, it is natural to suppose little dependance can be placed upon his judgment; yet we see this the case every day with respect to our wheat crops.

My wish is, therefore, to leave the general and particular practice to every man's own judgment, pointing out, however, a few requisites, *without which a grain of wheat cannot be brought to maturity in any soil, climate, or situation.*

One very material object I have in view, is to rouse the attention of landed proprietors to acquire a just notion of the value of their estates, and how far they can be converted to the general good. With this intention I have been led to speak of those people to whose care the management of

estates and farms is committed; for to their ignorance and prejudice may be fairly attributed the backwardness of agricultural operations in most countries.

The partiality which landholders entertain for having a bailiff from this or that particular country, is truly absurd; when the merits and abilities of the man are taken for granted, because he happens to be a native of that place. A strong provincial accent is as certain a passport for a landsteward to some of our agricultural fellow-subjects, as broken English or bad French is to qualify a foreigner for the place of my lord's gentleman, or groom of the chambers to my lady. Therefore do I condemn the infatuation which hurries men into *innovations in too general a way*. Among the customs long established in any country, *some* will be found really good, and the man of judgment will not overlook them. Indeed, at this very mature period of agricultural improvement, perhaps a proper selection of the modes practised throughout Great Britain and Ireland would surpass whatever any one man could presume or pretend to be acquainted with.

Agriculture, until within the last ten or fifteen

years, was considered as a pursuit beneath the notice of the scholar or the gentleman, and yet I know of no science which requires more extensive reading or greater talents; every branch of it is a system of philosophy.

Such is the estimation in which it is held by the Chinese, that one of the grandest imperial solemnities on the accession of an Emperor, consists in the Monarch actually breaking up a portion of soil with the plough in the presence of his subjects, as a pledge, that he will uphold by all means in his power the interests of agriculture, by which that extraordinary people have existed as a nation, from a period so remote, that its antiquity is almost considered a fiction.

And such ought to be the estimation in which this most comprehensive science should be held in the United Kingdom, which must doubtless be the case if the proprietors of lands, or the immediate servants of the crown, were fully impressed with its importance; for, in truth, whatever of power or prosperity these islands have arrived at, originates in agriculture; and to whatever extent the improvements of land may be carried, that power and that prosperity will keep

pace with them. If we wish to have our navy and army supplied with a race of heroes, we must seek for them in those soils which have been long famous for such produce.

The population of these countries requires to be increased to support the drain of its inhabitants called for by our extensive foreign possessions—and that increase can only be obtained by having abundance of food—bread corn in particular; and however extravagant or unreasonable the expectation may appear at first sight, I am of opinion we could support a population double the present number, provided the natural resources of the country were called forth. I know, with respect to wheat, that full twice the quantity produced by the present mode of management may be had, on an average through the kingdom, on the extent of lands now appropriated to its growth. And I know likewise, that an equal increase may take place in the quantity of stock or animal food; therefore, those who may feel disposed to aim at extensive improvement, shall find such information laid before them as will answer that purpose; and though no man can be answerable for the success

of any measure which depends upon the conduct of others, yet from a just theory, founded on principles of true philosophy, much may reasonably be expected.

Should any of my readers think that I have introduced matter into the following pages, not immediately connected with the cultivation of wheat, I must be permitted to say in my own justification, that as the subject is of first-rate consequence to the prosperity of the nation, I could not avoid endeavouring to call the attention of all classes of men to the consideration of it. And as the whole business of the preparation of the soil in various ways, involves a variety of minute circumstances, which I considered necessary to be pointed out, I was led to mention them as proper to be known by agriculturists: besides, it sometimes happens that the success in matters of great importance depends upon attention to trifles; and with respect to the bailiffs, I must be allowed to think that the prosperity of agriculture will depend, in a great measure, upon the skill of those who are intrusted with its operations.

CHAPTER II.

A new system of wheat management recommended as being cheaper than the old method, producing much greater crops, adapted to all varieties of soil and situation.—Absurdity of expecting smut or other diseases in wheat to be prevented by pickling.—Every day's experience of the fallacy of other methods a proof that they were not calculated to remove the evils complained of by farmers.—Appeal to different classes of men to promote the practice here recommended, by their influence and example.—Immense sums paid to the subjects of France for corn, one cause of the scarcity of specie.—High price of bread corn inimical to the prosperity of the nation.—Alarming state of the kingdom should the

next crop be deficient.—Importance of agricultural improvements in a financial point of view.

IN offering to the world a treatise on the cultivation of wheat; pointing out improvements by which the injury so often sustained from smut, rust, blight, and mildew, *may be entirely prevented,* and the too frequent recurrence of bad crops guarded against, I am aware of encountering much opposition and considerable doubts as to the efficacy of what the work shall be found to point out for the adoption of farmers; but I should hope that an attentive perusal of the following pages, and the theory therein recommended reduced to practice, would soon render a bad crop of wheat in Great Britain and Ireland almost unknown. Without being in the smallest degree an enthusiast, or blindly attached to any favourite system *invented by myself,* I may venture to state, with that reasonable degree of confidence resulting from persevering and attentive application to the subject, that whoever will take the trouble of reading, and afterwards follow on his land, the

rules pointed out here for the various operations of wheat management, may rest assured that he can banish from his premises those destructive enemies, smut, rust, blight, and mildew; and ensure, as a reward for his pains, a bountiful crop; nor will he find any extra expence stand in the way of such desirable improvements; for by the practice here recommended, the present actual cost may be considerably reduced—the land much improved for succeeding crops—whilst his wheat will be superior by at least £20 per cent. in every point of view.—As a further recommendation, I am (to use a parliamentary phrase) free to confess, that it is not exactly stating a mere system, invented *solely by myself*, or arising out of an imagination puffed up with ideas of my own superiority in agricultural knowledge; on the contrary, it is the result of minute investigation into the operations of nature in the nurture, growth, and maturing of wheat crops, compared with the process of agriculturists in various parts of the globe, under different climates, soils, and seasons, with every kind of manure in use, and the success attending their labors.—The connection of the philosopher and farmer is just so far pointed

out, as to explain to every capacity enough of theory to guard in future against the danger of bad crops in the whole extent of the United Kingdoms, in seasons generally reckoned inimical and unpropitious, whether from great droughts or too abundant rains, vernal frosts or summer blights; from every cause to which we now attribute the dearness of bread corn.—I court investigation from the whole farming body, and look with pleasing anticipation to the result.

Every man who either introduces a new invention, or revives an old one, is liable to that weakness which leads him to suppose his system deserving the unqualified approbation of the public, as he fondly supposes (such is the power of imagination) that his must be the best ever invented. This is the case with every projector, (and every man is a projector,) and this universal failing leads men of warm, sanguine dispositions, to hazard assertions which it is frequently out of their power to establish; and thus a zealous advocate, endeavouring to prove too much, oftentimes defeats his own purpose by not proving any thing at all.

The anxiety, (natural enough certainly,) which

every one must feel for the success of a measure that has cost him years of unwearied application; the difficulty of gaining proselytes, the advantages which he considers would result to the public from its adoption, the fame, the profit, or the silent, though heart-felt, consolation of his own approbation, in case of its succeeding, urge a man forward, regardless of those multifarious interruptions he is certain of meeting from apathy, from scepticism, from jealousy, and from ignorant prejudice; onward he presses, in the fond hope that merit, such as his, must overcome obstacles, which, to a looker-on, would appear insurmountable.

And thus I fear will it be with myself.—Where can I find refuge from all those *miseries* which an author is surrounded with? Who has the hardyhood to presume so far as to suppose the public will pay attention to any new *scheme*, as it will be termed, which has not the sanction of some great name, or which is not patronised by privileged authority? Some men may compile volumes of dulness, which shall pass current from the impression on the title-page, while

others, whether they write nonsense or otherwise, are condemned even without being read.

Having therefore no garnishing of that description, I determined to present this treatise in such a way, that if the reader were not to be captivated, he would have no reason to be deterred, by the name of the writer; and should it be found to possess any merit in the estimation of the public, the name of the author will be of no more use in recommending that portion of merit, than a popular name would be in dragging the senseless dreams of the easy chair into existence and notoriety. Besides, in this work I give very sufficient reason for not disclosing myself; for as I lay claim to some small share of agricultural knowledge, I must very much invalidate that claim should this treatise be condemned to the cheesemonger after having stated its being the result of much *laborious investigation,* and great, indeed unwearied application, for many years.

What then must I think of myself if the result of so many anxious days and nights, my experiments, my practice, my examination of the

practice of others;—what, I say, would any man think of me should this treatise on the Diseases of Wheat turn out to be no better than some which have preceded it even before I was in existence.

But I am determined to escape that mortification, and should the bantling become a favourite with the public, I may acknowledge it without a blush.

It is strongly in my recollection that many, and some of them very ingenious, men have already preceded me in this inquiry and failed of success; but that cannot operate to the disadvantage of my system, when a trial shall prove me to be correct.

Some writers on this important subject have mistaken the effect for the cause, which of course must have led them into a labyrinth of error:—some have amused the public with nothing but *conjectures;* and almost all have fallen into the same great error of supposing *one cause* alone sufficient to produce smut in every variety of soil, climate, and situation,—an error which has spread over the whole kingdom and produced the ridiculous childish idea, that a particular kind of

wash or steep for the seed corn will act as an infallible nostrum or specific to keep off these terrible disorders.

Let me here entreat, that whoever has read thus far and expects me to recommend any such stupid contrivance, will at once shut the book, for I protest, that *as no one cause produces smut, rust, blight, or mildew, so no one preventive can be security against their attacks.* But if after having his expectations thus early disappointed as to pickling, he can reconcile to himself to proceed in the perusal, I will venture to say, however infatuated he may have been by the doctrine of pickling seed wheat, he will have his eyes opened to its fallibility, and lay down the book with a firm conviction, *that England is equal to the support of a much greater population with bread corn produced from her own soil, without the necessity of importation;* and that pickling is one of those harmless inventions in no manner of use as preventing the injury done to wheat.

Let me also declare that I do not build the reputation of my system on the downfall of that recommended by others, I leave every man at free liberty to use whatever mode of practice he

pleases, and only solicit attention to mine in proportion as it shall be found to answer the purposes for which it is intended.

At the same time I may be permitted to say, that as nothing heretofore pointed out has been found effectual in ensuring good crops of wheat in general through these kingdoms, it is a fair presumption, that they were not calculated for that desirable object, and ought not to be persevered in merely from fancy or prejudice: the wants of a whole nation are too serious a matter to be liable to the dictates of fashion. The great landed proprietors throughout the empire ought to use their influence with the most enlightened of their tenantry and have a grave and solemn inquiry into what is here proposed as a means of guarding against a real calamity;—they should take some interest in an investigation which so nearly concerns their own as well as the comforts of the public. We find the leading men of the nation usefully employed in forwarding plans for the education of the poor—for promoting the welfare of the community in various other ways; and I should willingly hope these patriotic illustrious personages would condescend to forward the

exertions of an individual, who is employing the small portion of talents heaven has gifted him with, to ensure plenty to the nation, and prevent the necessity of applying to our enemies for a morsel of bread.

I would call upon the true friends of the country to support, by their example as well as precept, an undertaking which cannot be traced to any but the purest source, and which, if it should succeed, will be attended with inestimable advantages to every individual in the community.

I call upon them for assistance in a matter of no small importance, the magnitude of which would almost deter me from venturing thus before the tribunal of the public, were I not upheld by a conviction, that in doing so I am discharging a duty due to the general happiness of the community—a duty every man owes to his country as well as myself, and which he will but fulfil by assisting as far as in his power, to promote the adoption of the system here recommended, if it shall be found to answer the purpose.

The great and noble characters, the pride and boast of England, who have followed the glorious example pointed out by our reverend sovereign in

promoting agricultural prosperity, the chief bulwark of the nation; the reverend teachers of the gospel; the various societies associated for improvement in rural affairs; the many patriotic individuals who do good in the humble walks of private life. In short, all—all are interested in the inquiry, and if each individual will do his part, I have no fear of seeing the casualties of crops entirely done away with.

The sufferings of the poor in 1799, 1800, and 1801—the high price of bread these last two years—the prospect of the ensuing season—the hazard of a short crop of wheat next harvest—the situation we stand in with the other nations of the world in the event of actual scarcity—all these considerations should operate as stimulants to render us independent of avowed enemies and "war in disguise." The gold we sent latterly to the continent appeased the clamours of discontented France, whose farmers were almost goaded into madness by the oppressions of the government, until a market was found in England for the overplus of their grain; and though we refused admittance to their wines and brandies, we were compelled, by actual want, to take from them what they cultivated in

their stead; thus paying to Buonaparte's subjects upwards of nine millions sterling in one year, which, had our system of wheat culture been such as I am trying to introduce, would have been paid to our own farmers, and so much money circulated amongst ourselves.

But these are not the only evils resulting from scarcity of bread corn. The whole prosperity of the kingdom is affected by it; our internal resources are dried up; manufactures are at a standstill; the circulation of money is checked; discontent and dissatisfaction pervade all ranks; and the enemies of the nation thrive upon its miseries. It has been stated by a public character and promoter of agriculture, *that the necessity of importing corn from other countries has drained England of its specie;* if so, and that the necessity shall continue to exist, it is pretty evident that this specie will not find its way back in a hurry, and we may be under the obligation which want imposes of sending even more to procure bread.

It may easily be supposed that this specie will not find its way home to England so long as public credit shall be banished from the continental nations. Besides, the trade is really an un-

natural one, and every shilling sent to France or Holland for grain in specie is an absolute loss to the country; there is no profit to the public, as in a case where manufactured goods or colonial produce are exchanged for corn: here the profit makes some compensation, but in exporting gold we are trading to evident loss, and in importing grain, we are, in point of fact, carrying on a species of traffic injurious to the landed interest, because we should have that supply from our own farmers; and were I to give it a name, it would be calling it *a tax paid by slovenly management.*

It is my wish to introduce to the acquaintance of the British farmers a system which, if pursued, would render this country equal to the supply of her own immediate inhabitants, and enable her to have a redundancy to spare for the wants of our colonies.

Nor is it to be objected to me, that the attempt is absurd or the thing impossible; for if those who have doubts on the subject would but give themselves time to consider, they would find that the capabilities of this kingdom are far more than equal to the undertaking.

Hitherto those capabilities have not been

brought into action. No doubt there have been considerable improvements made in agriculture within these few years; yet I must say that we are very far behind in some of the most material branches of rural economy: in none more than the cultivation of wheat; of which statement, if we required confirmation, the extraordinary deficiency of last year's crop would furnish it to a melancholy extent. Should that of next season prove unproductive, the consequences might be of serious injury to the empire, as the stock on hand is unquestionably short of our required supply; and as far as I have been able to understand, there has not been so great an extent of surface sown with wheat as the consumption of England appears to require.

My object in this little work is—to put it into the power of the farmer *to carry the culture of wheat to any extent he may find corresponding with his interest*, upon every description of land, and to enable him to improve the present system, so as to grow a *greater quantity* and a *better quality* of this grain upon the land so occupied, without the usual and common risk of diseases befalling his crops, which he at present has no mode of

guarding against, and which it shall be my study to render as intelligible as the nature of the inquiry will permit.

There may appear, perhaps, to be nothing of novelty in a subject so common as the cultivation of wheat. The generality of readers, at least amongst farmers, will be very much inclined to think, that they do not stand in need of instruction on a point so familiar to agriculturists.

But let those who think so keep in recollection the reiterated disappointments they have experienced at harvest, independent of various other weighty considerations, and they must be blind indeed to all conviction and besotted with indolence, if the inquiry do not rouse them into attention.

I will venture to say, that a considerable portion of novelty, and of a very useful description, will be found contained in these pages, and that nothing has been introduced which the best theory and most improved practice will not sanction and confirm. Should any of my readers charge me with vanity for this declaration, let them consider how very ill it would be treating the public to introduce any thing to its notice of which I had

not a good opinion;—this is intended as an excuse for all authors as well as myself. As my intention in giving the result of my labours to the world really and truly is to render a service to my country independent of any empty honor from the fame, or any paltry consideration of the profit arising from the sale of the work, I have little anxiety about the reception it may meet with from any but the well-judging part of the community.

To clear up a mistake so extensively prevalent as the idea, that pickling wheat will prevent the diseases with which that crop is so frequently attacked, may be considered an undertaking of Herculean magnitude; such as it is, I have ventured so to do, and provided the farming part of the community will give attention to these instructions, there is in my mind little doubt that the attempt may be crowned with success. Let me here entreat the indulgence of the critic, which I have every claim to, as I do not write either for fame or profit; and moreover, I believe this particular species of writing is entitled to great privileges, at least if one may form a judgment from some agricultural writings which have found their

way into the world. But as ingratitude is a crime of which I would not willingly be accused, I must here acknowledge the kindness with which other literary labours of mine have been treated by the Reviewers, from whom I declare I have never received any but the most liberal and candid usage.

The imputation I dread most of incurring is that of presumption; for to such an extent do I carry my views, as to strike a greater blow at the French continental system than people are generally aware would be the case if we could overcome the necessity under which the nation at present labours of importing grain, particularly wheat, the value of which importation in twelve years amounted to the immense sum of nearly one hundred millions of pounds sterling;—*verbum sat.*

What I contend for is, that the agricultural prosperity of the united kingdoms may be increased to an extent greater than has ever entered into the calculations of financiers, for I do aver as a fact, the truth of which is fully impressed on my mind, that the rental of Great Britain might and

ought to be two hundred millions annually. The reader may stare with every indication of surprise and incredulity, but let me ask him what is the amount of rents this day, which one hundred years ago were 2s. 6d. per acre; and furthermore, let any man of common observation compare the condition of any one estate just now, with what it was even thirty years since, and he must admit that there can be no bounds set to improvements; and in fact, such is the situation of England, and so great its wealth, that if capital were more employed in agriculture than in *dangerous* speculations of commerce, such as we see every day, the real power and strength of the nation would be increased beyond all competition; we have the means within ourselves, but unfortunately they are ill-directed. It is unknown what might be accomplished for the prosperity of the country by taking the proper methods; in the revenue alone more than twenty millions annually could be added *at once*, and this not only without increasing the present burthens, but in reality, by lightening them. To sum up in a few words the importance of agricultural improve-

ments, let it be understood, *that sources are to be found through them* to create *a new revenue, greater than is now drawn from the entire system of finance,* a revenue which would increase with the increasing prosperity of the nation, and which would add to the wealth of every individual who contributed to pay it. Then let us hear no more of Buonaparte ruining our finances; if they are to be ruined, the deed will be done by ourselves.

CHAPTER III.

On the Question of "What soils are calculated for wheat crops," and "How far the cultivation of that grain may be increased and extended to the remote parts of the United Kingdom, where bread made from barley and oats is chiefly in use."

ACCORDING to the present practice of farmers a very small proportion of land is considered capable of bearing a wheat crop, and even that small proportion requires a tedious, expensive, and troublesome process of preparation, varying in different countries, not according to the different description of soil and climate, but as long prevailing custom may have established the practice, vague, arbitrary, and alike, through a large

district of land dissimilar in every respect. The master-piece of wheat management in most countries is naked summer fallow: that is, the land left for twelve months without yielding any sort of useful produce, then dunged and sown with wheat. Of this practice I shall treat hereafter; what I wish to speak of at present is *the choice of soils calculated for producing wheat.*

It will, perhaps, create no small degree of surprise in many of my readers when I state, that *all arable soils which will bear oats or barley can be made fit for carrying wheat;* the assertion may appear speculative; the truth may perhaps be doubted; but patience, gentle reader; it is an axiom in agricultural philosophy notwithstanding, and when sufficiently understood, will add much to the comfort of society. As you proceed further and get an insight into the doctrine of manures, you will be convinced of its truth; what I want to impress upon the minds of my countrymen is, that by an improved process in cultivation, they may raise crops of excellent wheat where the land (by the system practised at present) is totally unfit to bear that grain.

The soils selected for wheat are chiefly

strong clays, whilst the light sandy loams and poorer soils are generally supposed unfit to produce it. This is a fatal error in management, and causes many thousands to eat bread made from oats and barley in place of a better description; for these light lands, by the mode hereafter pointed out, would yield wheat of as good a quality and in as great a quantity as the strong clays, with less expensive cultivation, more certain, particularly in wet seasons, when the ploughing and other preparation of heavy soils are frequently retarded to a late period, and perhaps even then imperfectly accomplished.

Before I proceed further, I must remind my reader, that when he finds any thing stated herein respecting the victory gained by industry and judgment over what are erroneously called *insurmountable difficulties,* let him look at any improved piece of ground within his recollection, and this will be a sufficient answer to those objections which ignorance and sloth are ever ready to start; and let him remember—*labor omnia vincit*—which I translate thus—*perseverance overcomes all obstacles;* nor is there any mode of laying out

money which returns so certain and so large a profit as improving lands.

By thus confining the growth of wheat to a particular quality of soil, a kind of prohibition is proclaimed to the extended cultivation of the first necessary of life; a prohibition inconsistent with our actual wants; never warranted by any thing but our own indolence, arising from a slavish attachment to prejudice and bad habits.

Those on whom the practical parts of agriculture chiefly devolve, are inimical to improvements; they not only dislike taking any steps themselves, but throw every obstacle in the way of men who venture out of the beaten track, and whoever shall presume to act differently from the dictates of old and commonly absurd custom requires no small share of courage as well as skill. But as the interest of landlords is materially affected by the improvement of their land and their capabilities being properly known, I think they will be doing no more than acting with common prudence in ascertaining the extent to which a superior system of cultivation may be carried. Mountain farms, and lands situated in exposed

situations near the sea shore, are frequently neglected, and pronounced unfit for wheat crops.

This is a kind of summary judgment which the land does not always deserve; it is throwing the blame of their own indolence and want of management, on the soil; the occupiers are satisfied if, by a careless slovenly mode of culture, they can scratch over the imperfectly ploughed fields, and have a poor crop of oats or barley; so long as they sit at an easy rent, and their landlord does not look into their proceeding, all is well, they have no stimulus to improvement; on the contrary, they are rather interested in not shewing the capabilities of their holding, for fear of its value being known to the proprietor: thus many millions of acres are in a state of neglected culture, to the injury of the public and the loss of the proprietor. There is not any part of the climate of Great Britain where wheat may not be well and profitably cultivated; but the landlords must look into the matter themselves; they must not pay any sort of attention to the tenant, who tells them such and such land will not carry

wheat. It is a manifest absurdity for any one to fancy, that a bountiful providence created man to people the earth with multitudes, and yet made so much of that earth incapable of supporting the inhabitants with bread fitting for them.

If any person who is so prejudiced to old habits as to deny the improvements to be made by industry and ingenuity, and shall think proper to put my practice to the test of experience, he will soon be able to produce a crop of wheat on lands which shall have been pronounced totally unfit for that grain, although admitted capable of yielding oats or barley; the quality of the soil is immaterial, provided it be arable; whether situated in the Highlands of Scotland, Westmoreland, or Cumberland, or lying on the more remote parts of the sea coast. The disadvantages of soil, climate, and situation are more easily overcome than we are willing to imagine. The value of lands in what are now called *unfavourable circumstances*, is commonly taken at a wrong estimate, and the scanty supply of wheat in many parts of Great Britain is to be attributed to our

own bad management. I have already stated that the usual selection of strong clay lands for wheat is wrong when carried, as in many places, to the exclusion of soils of a lighter description. These latter are capable of producing as good crops by proper management, and I would recommend every proprietor of such to weigh well in his own mind the mode of practice herein recommended, before he shall reject the cultivation of wheat, or permit his tenants to do so. His own immediate interest is sufficiently at stake, and that of his posterity, to make the inquiry worth while.

I have known lands which the owner let at less than three shillings, and were capable of being made produce twenty-four bushels of wheat per acre, without expensive cultivation; but the occupiers were interested in concealing their capabilities. These lands were afterwards sold, and are now worth forty shillings, which they let for; and had the original proprietor given himself time to inspect properly the value of his estate, he would have had all that encrease which went into the pockets of another—but I may safely say—*de te fabula narratur*.

The case is applicable to nineteen in twenty of the landed proprietors through the kingdom. Some of the finest lands in Great Britain are so disguised by bad management as not to be properly known to the owner, and are let at a value much below what they ought to produce, without yielding either to landlord or tenant what both might enjoy.

Bad management is always expensive, and those who are terrified at improvements from an idea that they are attended with additional cost and charges are greatly mistaken in their opinion; the most improved practice is unquestionably the cheapest; and the land will yield more to good than bad husbandry; this is so very self evident, as not to require either argument or example to prove it. There are, therefore, many varieties of soils upon which the occupiers at present never venture wheat, which would produce that useful grain in considerable quantities if judiciously and properly cultivated. In some parts of the kingdom there are whole districts where scarcely any wheat is grown, and where the oat and barley crops are but very indifferent, where nature has furnished to the inhabitants, with a

liberal hand, materials for improving the quality of the lands which are most shamefully neglected; by the use of them, a prodigious increase might be made in the quantity and quality of their crops; they might have excellent wheat followed by oats and barley very superior to what they raise at present.

Their grass even would partake of the improvements, and be found benefitted by its introduction; to particularize any one part of the kingdom more than another where this system of bad management chiefly prevails, would be too partial; immense tracts of lands in Cumberland, Westmoreland, Northumberland, and various parts of Wales and Scotland are in this situation. The landlords of those estates are inattentive to their value, and the tenants ignorant of it; so that between one and the other, neither the public nor individuals derive that benefit and support which they ought from the bountiful gifts of providence, and from the apathy of men in general to all works of improvement, it is likely to be the case much longer.

This ought not to be permitted; landlords

should exert themselves and ascertain the value of their estates by finding out the crops they can be made to produce and pay most money. Very few landlords ever give themselves the trouble of inquiring into so important a point; they go on in the usual method, letting lands at the price of the country, or offering them to the highest bidder: in neither case is the actual value ascertained.

A landlord should first of all ascertain what crops his estate can be made to produce by good management; he should make himself acquainted with the natural advantages of it, as to the various earths and minerals on the spot or in the vicinity, which might be rendered useful in promoting its improvements. The facility of obtaining natural or artificial manure, its aptitude for growing one description of crop to more advantage than another, and the value of such crop in that part of the country; its capability of adding to or diminishing the powers of the soil. In short, a landlord, when about letting a farm, should know the value of every single acre, otherwise, he runs the risk of injuring himself

by letting too cheap, or *vice versa,* of injuring the tenant by letting too dear; the latter, however, does not so often happen.

I mean to be understood as saying, that *much more land is fit for wheat,* by proper tillage, *than the present practice allows to be;* and that the preparation for that grain may be cheaper and better done by paying attention to the following pages than at present. I mean also to say that wheat can be grown sufficient for the consumption of the inhabitants in the most remote parts of this kingdom, *upon lands where at present it is not attempted.*

This important conclusion may be drawn from the foregoing statement, that *instead of those lands capable of yielding wheat crops,* composing a very small proportion of the arable soils of Great Britain, *there is but a trifling part of our extensive surface which would not produce it in abundance.*

The practical farmer will soon find, that by adhering to the mode of management recommended in this treatise, he will not only have more bushels of wheat from an acre of land than

he receives at present; but he will find the weight of each bushel increased considerably, in consequence of the plant being supplied with proper nourishment and being in a state to profit by the supply.

The inhabitants of remote districts will be able to grow wheat, not only for their own consumption, instead of living on barley and oaten bread, but they will soon be in the practice of growing it for market. The increase of sustenance in such places will be followed by an increase of inhabitants, and the lands being found capable of profitable cultivation, will become a desirable object to cultivators. Thus will tillage be increased, and corn fields seen where a few straggling sheep are at present starved in winter, and even in summer not half fed. Population and plenty go hand in hand, and prosperity attends closely on their steps. Every improvement made in the agricultural department, which increases the value of landed property, adds so much to the resources of the nation; and in the present state of the world we are imperiously called upon to increase our own as much as we can. The extent to

which agricultural improvements may be carried is not to be measured by any advances which have been hitherto made in that science, because the management has been in bad hands. But when those to whose care farming concerns are usually conducted shall be rendered capable of their business, by a suitable education, then we may expect that rural affairs shall flourish.

CHAPTER IV.

Method of management for land already in tillage, without giving it naked fallow.—To prepare for wheat.

IMMEDIATELY after harvest give two or three ploughings and sow with winter tares, in drills about sixteen inches asunder; as soon as they shew themselves above ground sufficiently high, they should be stirred between the rows with a molding plough or horse hoe, so as to throw a little soil up to the plants; this would keep them warm and sheltered from the frosts and winds of winter, and would be equal to a ploughing by stirring the surface; in the spring of the year, as soon as vegetation commences,

and the weeds begin to grow, the same process of ploughing or horse-hoeing between the rows should be gone over again at two intervals of time, sufficiently distant from each other to break down the growing weeds; after which, the tares (if the season happened at all favourable) would grow strong enough to smother and destroy the rising weeds. In the month of June these tares might be fed off with sheep, cows, oxen, or horses, tethered or tied on the spot, which they would manure sufficiently well to enable the farmer after going over the land with a cultivator or scuffler, to sow a crop of the white Norfolk turnips, in drills about the same distance between the rows as the tares; these turnips would require one or two horse-hoeings, and at least two hand-hoeings. Should the season prove at all favourable, they might be fed off with sheep in time to have the wheat sown before the 20th of November, which on some lands would be quite early enough. By this mode of management, instead of losing an entire year's rent of the land, and having all the expenees of summer fallow to undergo without any direct return, with the cost and charges of carrying and spread-

ing dung. You have two crops of green food which will at least pay your rent and expenses, and you will have your land well manured by the animals which have been fed off on those crops. The ploughings and horse-hoeings given before sowing the tares and between the rows will sufficiently stir the soil and put it in order for carrying an abundant crop of wheat, and I can hardly suppose any other plan would answer so effectually to banish weeds and filth of every description as two succeeding drilled crops well hoed and fed off. Wheat, after such preparation, may be sown with every prospect of success.

Should the land be of that description to require being sown with wheat so early as September, the farmer has only to substitute the stone turnip for the white Norfolk, which is smaller but quicker in growth, and may be fed off in time for the sowing to be done in September.

I do not by any means intend to confine the landholder to the sowing of tares on his stubbles; cole seed would do in some lands better, and this fed off early in spring might be followed by turnips or tares. One example may serve for a thousand.

As I have no intention to enter into any argument on the merits of a naked fallow, I shall content myself with submitting the foregoing system to trial, without any doubts that the result will prove satisfactory to the farmer.

When the wheat has been sown, the first opportunity should be taken of hard frost to give the whole a top-dressing of from ten to thirty bushels of lime, slacked at least four months, and finely pulverised. The expence of this can never be considered an object of any consequence, and its good effects upon a wheat crop will be well worth whatever the lime may cost. Of the necessity for using lime I refer to the chapter on that subject.

As soon as the stubble has been cleared after harvest, if the occupier should be anxious to lay the lands down to seeds he can sow them along with rye after stirring the land with the cultivator or scarifier: the seeds thus sown will be as forward the following spring as if sown in the early part of the season among the wheat, a practice which is much to be condemned. The rye will help to protect the growing seeds, and afford a full bite for early lambs, of which they are remarkably fond, as it agrees particularly well with them.

Should the farmer not wish to lay his land down to grass directly after wheat, he may proceed with advantage in this way: let the wheat stubble be breast-ploughed, and, if the season and other work permit, burnt; oats or barley may then be sown in the spring, and seeds along with them or after harvest; by this mode of management a very fine crop might be obtained. Should burning in this case be inconvenient, the fold carried and fed on the breast-ploughed land, it might be ploughed, as usual, in the spring, and either oats or barley sown, as is the custom in many parts of the kingdom with very judicious farmers, by which means abundant crops are generally obtained.

The practice of taking three or four white crops after each other can never be sufficiently condemned, unless where a *proportionate dressing* can be given to the land; when that can be done, a farmer may crop, *ad libitum;* but whoever studies his own interest will never be so wanting in judgment as to exhaust his land by a succession of corn crops; the expense of bringing it again into a state of fertility, is greater than his former profits can afford to pay. The farmer who wishes

to put money into his pocket will always endeavour to keep his lands in good heart; it is the best, the easiest, and the cheapest mode of proceeding; and, as an encouragement to those who act so, landlords would do well to make some abatement in the last year's rent of farmers who are giving up their land in such a state as a farm ought to be; a part, or perhaps the whole, of which abatement an incoming tenant might better afford to pay than many expenses which he would incur upon a worn out farm.

When the land intended for wheat is of that very strong, tenacious description of clay, which many people think cannot be prepared without a naked summer fallow, it may be necessary, perhaps, to adopt a different course of proceeding; for this purpose I would recommend the use of an implement to precede the plough and overcome the adhesive obstinacy of the soil, having three or four coulters, without any share, for the purpose of cutting the surface in small narrow furrows or stripes, which is more effectual in its operation than the scarifier.

This having been drawn lengthways and crossways over the field, might be followed by the

plough best adapted for the soil (proper weather considered) and when the land has been found in a state fit for the operation it should receive three, four, or five ploughings, as soon after each other length-ways and cross-ways, as can be conveniently done, putting in the winter tares after the last plough, with a proper drill, and so proceeding as already stated. After the tares have been fed off, if the land should require further working to more thoroughly pulverize the soil for turnips, the above implement may be used, going over the field as often as may be necessary, which will answer that purpose better than turning it with the plough, as not burying the manure too deep.

In fact, turning up such land in a naked fallow, even with a narrow furrow, very frequently only exposes it to be hardened by the sun into an impenetrable brick, and causes the operation of ploughing to be a work of great labour and difficulty.

Should the land or season be unpropitious, rape may be sown after tares, and fed off with sheep in sufficient time for wheat sowing; or in some cases a crop of cabbages might be had if dung were plenty.

There may be lands so peculiarly situated as not very well to admit of the fore-mentioned modes of proceeding to be followed implicitly; but an intelligent cultivator, who is not blindly attached to the old fallowing system, can easily suggest such an alteration as will be found to correspond with circumstances, and admit of green crops drilled and hoed to occupy the land intended for wheat, instead of allowing it to remain an unproductive and barren desert for twelve months. This expensive system of operations (naked fallow) must, to a certain extent, retard the culture of wheat, and of course prevent, so far, the abundant supply of that useful grain, which we might have if the farmers could proceed in a track less expensive than the present, and feel it more to their advantage.

Could an occupier of land find, that by managing his farm in the way pointed out above, his wheat crop paid as well as it does at present, *without the cost and charges of fallowing*, and other great expenses, there can be little doubt that the encouragement to sow more would be sufficiently great to insure an abundant supply for our consumption; and if candid, intelligent

men would give themselves an opportunity of making the trial, I have little doubt they would find it their interest to continue the practice.

As I write for the information of the farmers, at least for those who may stand in need of it, in all parts of the kingdom, it will be by no means irrelevant in this place to state a mode of practice in the culture of wheat which has been pursued for ages back in a part of England where they generally raise good wheat crops; and in stating this I am by no means to be understood as advising any man to adopt the plan, that is left to the discretion and free-will of every farmer, who may of course judge for himself.

It frequently happens that a fallow shall be manured with muck, in which the seeds of weeds have been thrown out from the thrashing floor. The occupiers of land in the country I allude to, in order to guard against the injury which their wheat would sustain from being choked with pelf or rubbish, sow a crop of oats in the spring; these generally prove an over-match for the weeds, after which they are in the practice of growing wheat of most excellent quality, particularly clear

and free from weeds. As I have already stated, it is by no means my intention to propose a system of universal practice; therefore, when I mention any routine of cultivation, it is for the consideration of the practical farmer. I must, however, in this place, state a very important particular about sowing wheat after mucking, and that is, that in the way *much is managed at present;* the crop is not unfrequently greatly injured either by an abundance of weeds, or, in many cases, by smut, rust, blight, or mildew, the cause of which shall be explained in the sequel of this work, in order to caution the occupiers of land from falling into the error.

In many parts of the kingdom wheat shall be sown after beans or peas. Without due attention to circumstances this is by no means a capital system; both beans and peas require from the soil the *very same sort of nourishment* wheat does, and therefore, unless the preparation for these crops has been attended to with uncommon care and judgment, the result will be not quite so satisfactory as the farmer might have anticipated; that is to say, in lands of a *middling* description. There are certainly some soils, which, being emi-

nently gifted by nature, are of a texture peculiarly adapted for these crops; and on such they will do better, although the land, unless very well dressed, will assuredly be much exhausted by two crops requiring such a quantity of the same substance to bring them to maturity. I would therefore, by all means, recommend those farmers who possess lands strong and capable of great produce, *never to push them to the extent of their efforts;* such conduct being little less than downright robbery, whether committed on the landlord or the tenant.

It may be proper here to take notice of the practice so very general of sowing wheat upon a clover layer, which has been fed off with sheep.

The usual mode of proceeding is to plough with a very shallow furrow, sow the wheat on the back, and harrow it in.

I must observe, that wheat thus managed, though it sometimes turns out very well, is not to be depended upon for a certain and good crop; it is very often much injured by smut, rust, blight, and mildew.

Whence, it will be asked, do they proceed? For an answer to that query I must refer my

reader to the chapter treating of these diseases, and shall generally observe on the practice of sowing wheat in this way, that it is far from being a good one, although so much followed. There is one fatal error committed which ought by all means to be rectified; that is, ploughing in the strong tufts and roots of the clover and rye grass. The impropriety of this mode of management will be pointed out more particularly in the chapter on securing wheat from disease by proper preparation of the land. Were I to venture any instructions on the subject, they would be to plough as shallow as possible with a narrow furrow, then cross-plough; and after well harrowing, it would be highly proper to run the scarifier over the whole, to turn up the tufts and clods, which should then be gathered in heaps and burnt, the ashes being spread on the surface after the wheat has been sown. Farmers in general suppose these tufts and clods do no sort of injury to the growing crop of wheat, and therefore would consider the extirpation of them as an useless expense; but this is a mistake which does a great deal of mischief, and if people would but open their eyes, they must see it in that light. I

have had an opportunity of examining each half of a clover layer prepared and sown in the two methods; the difference of the quantity and quality of the grain on threshing was so much in favour of the latter system, that no man of common sense would hesitate about adopting it; one was greatly injured by smut, whilst the other was perfectly free from any appearance of it; indeed where the division was up the middle of the field, you could plainly trace the smut all up the land ploughed in; whilst that which was burnt was untouched; the healthy and diseased wheats were just divided by the furrow where the different operations commenced. I might here mention another instance of bad management in the culture of wheat which I was witness to, as examples are of more efficacy than arguments. A farmer who was in the habit of receiving premiums from a society for promoting agriculture, ploughed up an old green-sward field of eight acres, harrowing in the seed broad cast. As the land had been covered with sheep and cows he anticipated a good crop, indeed an extraordinary fine one; and as I was in the custom of passing through his farm almost every day, he generally

asked my opinion of his mode of management with a clumsy sort of vulgar irony or low wit; knowing the man was as obstinate and self-opinionated as he was ignorant, I overlooked his confident sneering, and, in order to have done with his importunities, told him one day, that, as to his mode of management, it was no business of mine to find fault with what he or any other man thought proper to do in the cultivation of his land; but that I could plainly foresee he would have his crop very much injured by the smut.

He had a bailiff in the field who having answered the sly wink of his employer with one equally significant, told me, with as much truth as wisdom, if we lived till harvest we should see. The event justified my opinion; the wheat was so smutty that it did not yield more than ten bushels to the acre, and that only indifferent grain. This man and his bailiff had now a proof sufficiently convincing, that I was correct in my judgment, on which account they left off asking my opinion in derision, but made it a rule to follow my practice.

The cause of the smut in this case may be

easily ascertained by the reader having recourse to the axiom laid down in this treatise. He will find, that *the plant whilst growing was deficient in those physical powers which would enable it to extract from the soil the ingredients necessary to its support.* This deficiency he will also find to have arisen *from the roots of the green-sward interfering with, and preventing the growth of the lateral roots of the wheat plant.* The wheat in other grounds round this field was very fine in quality and abundant, therefore the cause of smut *may be presumed* to have been local.

Should any man, as no doubt will be the case, require a familiar case in point, or that the author of this treatise should reason from analogy, I will instance the case of a gooseberry-tree which has been deprived of its leaves by insects. We do not find the fruit to flourish, it soon decays: again, fruit trees planted in a soil where the substratum is inimical, their produce becomes blighted at a certain period of their growth, and is devoured, leaves and all, by insects, in consequence of the roots not being healthy; but in short, if we look with the eye of scrutiny, we

shall find every vegetable production in nature may be made to furnish a case in point

If every other plant, great or small, requires *its roots to be perfectly formed and properly disposed in the soil,* which all botanists admit, in order to mature its seed or fruit, must not wheat be entitled to at least as much fair play? Or are the properties of this plant different from all other, and can it prosper under an imperfect state of culture? All I then ask, is the cultivation to be conducted upon the same principles which guide us in growing other vegetable productions? If that were once generally adopted, there would be little doubt of the wheat crops being abundant and regular, instead of being scanty and precarious.

As my object is not only to point out improvements in the cultivation of wheat, but to expose the errors in some parts of the present practice, I find it necessary here to state, that in preparing land for this crop, one of the most material points to be observed is, *to thoroughly clear the soil from every impediment in the way of the roots of the plant;* for if even one of the fibres

shall be prevented from performing its part in the process of vegetation, the injury will be felt to a certain extent; whether that impediment shall arise from the roots of the wheat itself when sown too thickly, or from the fibres of weeds or grasses imperfectly destroyed.

CHAPTER V.

Breaking up old turf by paring and burning recommended.—Paring deep never diminishes the soil, as some people imagine.—Ashes better in quality when burnt in large heaps.—Burning may be done in winter.—Ashes to be used as top-dressing.—Importance of charcoal as a dressing to land.—Its properties pointed out.—Mixture of lime recommended.—Errors committed by farmers in applying caustic lime.—Reason why paring and burning appear to be injurious.—Injury done to land in converting turf to tillage, when in the hands of unskilful operators.—Wheat and barley may be grown in succession for any length of time by dressing the land with suitable compost.

IN the foregoing I have stated that the larger proportion of soils in Great Britain are capable,

by *proper management,* of producing abundant crops of wheat. In this chapter it is my intention to point out certain modes of preparation adapted to that description of land at present considered most expensive and difficult in converting to tillage, because it is unquestionably true that a system of *universal* management will never answer, and that whoever should presume to offer one, would insult the understandings of his readers, and betray the grossest ignorance of the laws of nature.

It is not any part of my plan to enter into a controversy about the merits of the fallowing or non-fallowing mode. I leave every man to the uninterrupted enjoyment of his own *opinion,* and shall merely state different courses for his consideration, without presuming to dictate as to what line he should adopt.

Management of old turf and newly-inclosed common or waste lands.

In breaking up these two kinds of land, I would by all means recommend the same course of proceeding in one part of the operation, that

is, *to pare and burn the surface as deep as the roots of the sods shall be found to extend.* I am aware this is not the usual mode of proceeding; in general the idea is, that by cutting deep you *burn away and diminish* the quantity of the soil: no supposition can be more unfounded; all chemical experiments made upon the earths prove the fallacy of this opinion. The sods are then to be set on fire and *burnt in as large heaps* as can be conveniently done; this also is contrary to general practice.

My reason for recommending large heaps is, that you have at least four times the *quantity* of ashes, and every cart-load burnt in *large heaps* is worth two of what can be had from burning in small.

Another reason for burning in large heaps is, that when the fire shall be well lighted and the heap properly covered with sods, no weather, however wet, can extinguish it; and the operation of burning may be proceeded in through the winter, when work is scarce and labourers easily to be obtained, so as to put the land under crop in spring, gaining by these means a clear half-year's profit.

The fibrous roots and vegetable part of the sods, when burnt in *large heaps*, are converted into charcoal, which is invaluable upon land; whilst they are in *small heaps* burnt to *white ashes* of little comparative use for promoting vegetation, and the earthy part of the clods, when well burnt, contributes in a very remarkable manner to improve the general quality of the soil upon which it is spread, causing it to produce a sweeter and, every way, better herbage than it did formerly; this may be seen by the spontaneous growth of white clover, trefoil, burnet, and various other fine qualities of grasses which would not before grow thereon.

In applying the ashes, I would strongly recommend their being used as a *top dressing*, and not as is most generally practised, ploughed in and buried below the surface, far from the influence of the atmosphere, and, indeed, the chief part below the reach of the roots of corn in any way. When applied in this manner, the ashes of an acre of ground will serve as a top dressing for six years either for corn or grass, thus creating a magazine of excellent manure, and ensuring fertility to the soil and prosperity to the farmer.

I have stated that the surface or turf burnt in large heaps produces charcoal: it may create confidence in the practice to enumerate some of the uses of that article upon land; to give a full explanation of its properties would occupy a separate treatise of no inconsiderable size; I shall therefore state, as briefly as possible, that charcoal is one of the most valuable materials in the hands of the agricultural cultivator, being not only carbon in one of its best forms for furnishing the food of vegetables, but from some other properties which it is known to possess, highly important in the process of vegetation.

Lampadius, professor of chemistry at Friburgh, has discovered that charcoal decomposes water and atmospheric air at the *common temperature*, furnishing by this remarkable process to the growing vegetables, Oxygen, Hydrogen, Nitrogen, and Carbon; a discovery of very considerable interest to the promotion of agricultural improvement.

Charcoal also by its affinity to oxygen operates thus: soils too much impregnated with metallic oxyds may be deprived of their superabundant oxygen by charcoal, which, uniting with it, forms

carbon, and thereby affording an abundant source of food for the growing plant, leaving the soil thus neutralized and more friendly to vegetable life.

The neutral salts found in the ashes of vegetables are, sulphats of pot ash, of soda, and of lime; muriat of soda and acetate of pot ash, with oxyd of iron and manganese; these are all benefieial and powerful agents in vegetation, and prove, that ashes, when obtained from paring and properly burning, are deservedly to be classed among the most fertilizing and improving of all substances used by the farmer; it cannot, therefore, be a wrong system to pursue, which produces so valuable a result; nor is there any process as yet known, when *well conducted,* that works so speedy, so effectual, so cheap, and so lasting an improvement upon every description of soil as paring and burning; nor is it any trifling recommendation to say, that it banishes every species of grub, and other devouring inseet from the land.

Having thus recommended paring and burning to my readers, I shall further observe, that the quantity of ashes to be spread over the surface as top dressing must be entirely regulated by the

quality of the soil and the state of fertility it may be in at the time, beginning with seven bushels per acre, (the complement usually spread on, of the famous Newbury peat ashes) up to any number of bushels which *the state of the land* may render necessary.

The remainder of the ashes ought to be made up into a heap, covered over with a thick coat of earth, and well thatched to secure them from the weather. In this state they may be preserved for any number of years in order for top dressing the land when necessary.

To render the system of top dressing with the ashes of burnt sods as beneficial as can be expected, and to enable the farmer to derive the greatest possible advantage from this plan of operation, I must recommend an addition of carbonate of lime, or lime *slacked for sixteen or twenty weeks*, to be spread on either directly after the ashes, or which might be as well perhaps, to mix it with them, the lime being, previously, thoroughly pulverized, in the proportion of *from five to twenty and up to thirty bushels* of lime per acre, according to the description of land on which it shall be used.

This mixture forms the *calcareous nitre,* or, to speak more scientifically, the *nitrate of lime;* an auxiliary to the farmer of first-rate consequence, the benefits of which can never be sufficiently appreciated, and which, in the effect it produces on the wheat crops is of very remarkable use, particularly in contributing to the formation of ammonia. It has besides the peculiar property of attracting moisture to the growing vegetables in seasons when long continuance of excessive drought has proved extensively and seriously injurious to every description of crops; but let me strongly impress on the minds of my readers, that the lime should be slacked at least sixteen weeks, and repeatedly turned previous to spreading on the land or mixing with the ashes.

Should this precaution be neglected, or should the operator think it needless, a great mistake must be the consequence; for lime applied in a caustic state will have a directly contrary effect, and the farmer, disappointed in his hopes, will condemn the system altogether, without perhaps considering, that had he implicitly followed the directions herein pointed out, the good effects on his lands would have been visible to any observer;

and as the generality of farmers cannot have any idea of the difference (to land) between lime fresh burnt and lime slacked for five or six months, they will do well to take as a general rule, *that caustic or new-slacked* lime *destroys*, for a time, the fertility of land and *prevents* vegetation, whilst carbonate of lime or lime long slacked, promotes both the one and the other. But of this and some other properties of lime, I shall treat more fully in a chapter on that subject.

The practice of paring and burning for improving land and producing luxuriant crops has been traced up to the most remote antiquity; but like every thing else, its value may be incalculably encreased in the hands of *a skilful operator;* and I know of no reasonable objection which can be offered to its adoption, unless it be, that land treated this way being found to yield abundant crops, the unskilful, or as more frequently is the case, the unconscientious tenant, who never for a moment considers the interest of his landlord, goes on cropping after manuring in this way until he exhausts the land of its powers; in this case, as every effect must proceed from some cause, the operation of burning is condemned, whilst in

fact, the want of honesty or want of skill in the tenant is the source of the evil.

In many countries tenants are restricted from paring and burning; this restriction taken in its totality, I must say I condemn. The landlord and tenant might meet half way; let the landlord permit his tenant to burn under certain restriction of crops and a well-regulated management, and I have no doubt both parties would be benefited by such an arrangement; but I by all means recommend the landlord to give no permission of burning unless under *proper regulations as to future crops.*

Should the land in preparation for wheat be burnt in the winter, a crop of spring tares might be very advantageously grown thereon, and either carried off or eaten off with sheep, (the latter in some lands of a light description infinitely preferable) in sufficient time to prepare for and sow wheat during the month of September: when I say tares I by no means intend to exclude turnips, potatoes, cabbages, or even a corn crop; but these must depend upon circumstances, which, as they vary in every farm, so the occupiers are left to adopt whatever their judgment shall point out

as the most proper to pursue; but in every case where burning has been performed in winter, and a spring crop obtained before wheat, there will be *a clear profit of that spring crop*, whatever it may be, over and above paring and burning in summer, the most usual time for the operation, from an improper idea that it can only be done in warm and dry weather.

That wheat of excellent quality may be obtained from land of a very inferior description naturally, by paring and burning the surface, is too well known to admit of a doubt; but by attending to the instructions on compost manures, and delivering the seed into the ground, hereafter stated, the culture of wheat will be still further rendered intelligible on unerring principles.

There is less difficulty in doing things *rightly* than we are willing to admit, and a man who will take the trouble of inquiring, is almost certain to be rewarded with conviction, though at the same time we daily witness the absurdities committed by those who are very improperly entrusted with the management of great estates. Landlords and men of hereditary fortunes are seldom *deeply* read in the science of agriculture, to which

there is, as Euclid said of mathematics, no *royal road*; they are satisfied to entrust the important concerns of twenty or thirty thousand acres of land to a manager who is without any one qualification to fit him for the situation.

It would be considered a very preposterous mode of acting in a man whose health was impaired, to consult the coachman or groom of an eminent physician, and yet the care, the management, the occupation, and other matters appertaining to landed property, are entrusted to men who are as little acquainted with the science of agriculture, though in the employment of a great landed proprietor, and perhaps having driven his ploughs, as the coachman or groom of a great medical practitioner can be with the science of medicine, because they have sat upon his coach-box whilst in attendance on his patients. How is it to be expected, that a land steward can be competent to the arduous task of directing a tenantry on a great estate so as to do justice to the landlord, when he may be, perhaps, more ignorant of the nature of soils than the very worst informed man in the entire circle of those tenants over whom he exercises

jurisdiction. I have repeatedly endeavoured to convince bailiffs, or the head men in farms, that *ploughing in ashes deep* was robbing the farm and spoiling the crop, but in vain; I generally found them too ignorant to understand, and too self-sufficient to be directed in the process by another.

The very great superiority which ashes possess over most other fertilizing substances, consists in their not being so very soluble in water, nor so liable to be carried off in a gaseous form. This is a particularly important quality on lands which are so very light or loose in texture, that farm-yard dung applied in large quantities shall be washed by the rains far below the surface, and removed out of the reach of corn and grasses: these are called, very appropriately, *poor hungry soils*, and no term can be better applied. Ashes spread on such land will be found to improve it much more than any other dressing, because they will hold their situation near the surface where they can be of use, and they will impart greater fertility than muck of the best description. Ashes, moreover, do not encourage weeds, muck produces them in great quantities; ashes are much lighter of carriage. The wheat grown after a

dressing of ashes will be found of very superior quality to that grown after muck; the flour will be whiter, the bran less, and the grain much heavier; nor will it be by any means so liable to be attacked by smut.

In short, I consider a proper system of paring and burning to be the very best preparation a farmer can adopt to ensure a good crop of wheat, and as such I can recommend it to the notice of my readers, with the fullest conviction of its value; but let me at the same time impress upon their minds to keep the ashes as near the surface as possible.

That my readers may be enabled to derive as much advantage from the instructions contained in these pages as is in my power to furnish, I think it necessary to observe, that in soils which are very much exhausted and worn out by a repetition of crops, it might be a very excellent mode of management to give them in the first instance a liberal dressing of old rotten farm-yard dung, well turned and divided, after which a sprinkling of ashes harrowed in with the seed, would be a preparation for wheat likely to produce an abundant crop and of fine quality. I must be under-

stood as looking to the certain quantity of lime being applied already recommended in another part of this work, and, though I may incur the imputation of too much repetition, it appears to me necessary in this place to remark what I have stated elsewhere, *that a good crop of wheat cannot reasonably be expected unless lime shall have been naturally or artificially in the soil;* therefore, in every preparation for this crop let me be understood as recommending a portion of the carbonate of lime.

There is scarcely any operation connected with agriculture, which I have found greater difficulty in conducting *as it ought to be,* (that is to the best advantage,) than paring and burning. Labourers in general dislike to follow any method, but that with which they have been previously acquainted. Their obstinacy in adhering to their own customs is a considerable obstacle to having work well done of any kind; and that other class of farming servants, which I have had occasion so repeatedly to take notice of, the bailiffs, are equally strenuous or rather mulish in their opposition to innovations; in short, between the two, a man must have great perseverance to accomplish any

material alteration in the usual method of practice. This blind and prejudiced attachment to *inveterate* habits arises as I conceive chiefly from their being totally unacquainted with any theory on the subject, and their not having the most distant idea of the connection between causes and effects; this, in short, is the foundation of all the errors, which we see committed every day in the practice of agriculture; and until the class of men to whose management farming business is entrusted, shall lay the foundation of their practice on a scientific base, such errors must naturally occur.

Let me then impress upon the mind of the reader, that in burning the surface of a soil, *the fire cannot be kept too much smothered;* that the larger the heaps, the better will the ashes be, and the greater the quantity: one acre of green sward burnt in large heaps, and another burnt in small, will convince the farmer of the truth of my observation.

Breaking up old turf, without burning, and giving the land five or six ploughings with a summer fallow, is a mode of management which most of my readers may have seen; it is, however, an expensive and, not to say worse of it, a

clumsy operation. I have, however, been witness to other modes of management with old turf, which deserve to be made known in order to guard against them.

It is by no means an unusual custom on a piece of old turf intended to be converted to tillage, to spread a heavy dressing of manure, or in some instances lime, not unfrequently both lime and farm-yard dung mixed; then to plough down the sod, and sow, as the case may be, either wheat or oats thereon. This mode of management I have seen often practised by men who had obtained the reputation of good farmers.

Perhaps a worse system could hardly have been adopted; for in the first instance the muck which had been laid on the old turf would have been much better applied on some other portion of the farm where it was more wanted, whilst the old sward should have been pared off and burnt; the ashes, in case the process had been well conducted, would have been sufficient to give the ground from which they were obtained an abundant dressing, and enough would have remained to manure twice or thrice the same extent of surface; moreover the hoards of insects which

are always so abundant in land long laid down, and do such injury to the three or four first crops, would be got rid of at once.

Whilst enumerating the advantages of paring and burning old sward and contending for the superiority of that practice over any other which can be pursued, it will be proper here to observe, that ploughing in the sod renders the land hollow and light, causing the corn sown for the first two or three seasons to be injured by frosts and cold winds, which find their way to the roots and do a vast deal of mischief; this is a matter which deserves to be held in remembrance by farmers who have such lands to work upon.

There is no operation of agriculture more dangerous in its consequences to land than the converting old greensward or turf to tillage, if in the hands of an unskilful or ignorant practitioner: when the process is imperfectly or improperly conducted, the land may be rendered unproductive or almost sterile for years to come. Landlords should, therefore, be cautious to whom they entrust such an important matter, because, in proportion as the improperly conducting it may injure, and, to a certain extent, destroy the

land, by so much would a judicious and well-regulated system add to its value. For instance, I have seen a parcel of old turf ploughed in and sown with oats for three or four years successively, during all which time they had little more than seed returned for their labour; and in the same estate another parcel pared and burned, which yielded five quarters of superior wheat to the acre the first year, and has borne wheat and barley alternately every year since, with a top dressing of compost manure: and so long as a similar process shall continue to be pursued, the land will carry these valuable crops without being in any degree impoverished; because, in preparing the top dressing, those materials are provided which are necessary to the formation of a grain of wheat and barley.—A *modus operandi* that if attended to by farmers, would enable them to grow wheat on the same land year after year.

CHAPTER VI.

On the causes which produce the smut, rust, blight, and mildew in wheat.

I AM now going to enter on that part of my subject, the importance of which is such as to deserve the attention and investigation of every man who has the welfare of the community and the prosperity of the country at heart; and in treating of the causes which so frequently disappoint the labours, the hopes, and the wishes of both growers and consumers, I am not about to give to the world a fanciful theory, or the speculations of the closet and arm chair. I am going to offer the result of laborious investigation, pursued with unremitting attention, in a variety of soils and under different kinds of management; to follow nature as my guide through

many of her intricacies, and, if possible, lead the practical farmer into a safe and certain path.

In a climate like that of Great Britain, a more than ordinary degree of attention should be paid to secure our crops, particularly wheat, from the vicissitudes which they are subject to from extremes of heat and cold, drought and moisture; but, unfortunately, that necessary attention is not paid, and the consequence is, that a crop uniformly good through the kingdom, is a thing never known; in some parts the produce is very abundant, in others very scanty. One season the hills produce well, whilst the vallies are deficient; next year the reverse proves the case; lands of the best description oftentimes producing the poorest crops; this year particularly, the strong lands have yielded very inferior to the light soils, and spring-sown wheat, contrary to general usage, has produced the greatest return.

The complaint is not confined to this or that district; it is universal through the kingdom; every farm has suffered in a greater or less degree; and a good crop is, perhaps, not to be found in the island. Whence arises the injury sustained by the wheat throughout Great Britain? The

general answer is, from a bad season, from blight, from mildew, or in short, from some favorite cause which each selects according to his own fancy; but none of them the real origin of the evil so much complained of. It has been said by many people, that the wet which fell so abundantly at one part of the summer was the cause of the crop being injured; others have laid the blame on the frosts in spring; but it would be endless to enumerate the conjectures advanced on this occasion. The truth of the matter is, that *an imperfect system of cultivation prevails through the whole kingdom; and, that in consequence of it, the crops of wheat are liable to various injuries in all seasons and in every quarter of the island; and that in no year but one for the last twelve has there been any weather in which a very good crop of wheat might not have been obtained by proper cultivation and management, and even that year* (1799) *there might have been a fair average produce.* It is necessary for me to state further, *that so long as the present system shall be persevered in, we can never look with any degree of certainty to good produce of wheat;* there may now and then, or in partial spots, be a good

crop, but it is not to be supposed we can grow sufficient for our own consumption.

Will the reader bear with patience to hear the whole body of farmers in Great Britain condemned? Will he not think the writer who presumes to do so guilty of unpardonable boldness? He will very naturally say, if all these practical farmers who are now in possession of the soil, and all who possessed it for centuries back, are and have been following a wrong mode of proceeding in the cultivation of wheat, where or how has this man acquired such knowledge as can enable him to give instructions to all the nation?

My worthy friend, I have stated in the outset, that it is not a theory nor yet a practice of my own invention you are about to read; nor am I venturing so far as to condemn the whole system at present pursued, I merely say that an *imperfect* mode of management prevails; and although every farmer who cultivates wheat is actually *right* in *some* of his practice, yet it must also be said that he is at the same time wrong in others; and that this mixture of right and wrong prevails through his entire operations, whether ploughing, manuring, preparing, or sowing; nor is each

man right or wrong in the *same* points; and so long as a capital error shall exist in any one man's practice, the chances of a failing crop will continue. My object is, therefore, to select the more excellent parts of the system pursued in different quarters of the kingdom, and forming from the whole a *modus operandi*, which will guide the practical farmers into a path, where, seeing their way clearly before them, they can proceed without danger of going astray.

Writers who have preceded me on this important subject, seem to think that the cause or causes are merely a question of science, whilst in reality they are so connected with, as to be inseparable from, practice as well as theory.

But when they have dared to lay the blame at the door of Omnipotence, and accuse a bountiful providence with destroying our crops by pestilential blasts of electricity; by those fructifying showers which replenish the earth in spring; they then add to want of judgment the grossest impiety.

There is a peculiar difficulty in extending agricultural information, so as to make it the means of improving practice; men read, are amused,

but the dislike to innovation prevents trials being made. A departure from old-established customs carries with it the appearance of so much danger, that very few will venture on the attempt. Variety in the characters of soils causes different modes of management to be pursued in different places, and farmers will seldom give themselves time to compare and examine to see how far these various systems could be brought to correspond; could this be done, the selection of good customs and the rejection of bad, would soon introduce important improvements through the kingdom.

For the present I may be permitted to remark, that the improvements herein recommended for the management of wheat are so very simple and interfere so little with old practices, that farmers may have less apprehension about their adoption than if they were more complicated or speculative.

A grower of wheat may very safely make trial of any one thing herein recommended, without risk to his pocket or his crop. As to any speculations in so important a concern, it would be far from my wish to recommend them, but to point

out to a Southern farmer a practice which has succeeded to admiration with another in the North, unconnected with difference of climate, cannot well be stigmatised as speculative or fanciful.

As the diseases to which the wheat crop is liable in Great Britain and Ireland has been a subject of anxious and interesting inquiry with me for many years, it may naturally be supposed, that during such a length of time I availed myself of every opportunity to acquire information on the subject from those who might be supposed most likely to communicate any; and also to ascertain, as far as was in my power, what methods had been tried, and the result, to discover the true source of these diseases, and what were the best means of preventing or guarding against them.

It appeared very extraordinary to me, and doubtless must do so to my readers, that for a lapse of time so long, and a calamity so fatal, there has not been any preventive even guessed at except the old useless one of pickling seed wheat; from which, whatever some people may think proper to assert, it is absolutely impossible any good effects can arise; yet I have seen farmers

who would insist upon it as answering the purpose *in some cases;* but no man has ever ventured to say, so far as my recollection serves, that he has found it uniformly successful.

If then pickling wheat is admitted by its greatest admirers and warmest advocates to be useful *only sometimes,* it is a fair inference, *that this operation is not an effectual preventive.*

Indeed no well informed man on the subject would ever give himself leave to think that it could be; and I find many farmers who had followed the practice for years have discontinued it, from a practical conviction that it was, as a preventive of disease, entirely useless.

The many valuable receipts for steeps, for pickles, and for liming, I give back to their authors as useless lumber. The complaints of many farmers that certain lands are more subject to smut than others, I believe are well founded; but those very lands may be so altered and improved as to retrieve the lost character of the soil. One thing I must insist upon, which is, the unspotted innocence of the barbary tree, as to the crime so often laid to its charge of causing smut in wheat.

In short, I must intreat my readers to divest themselves of every partiality for former opinions adopted on this subject, and to give proper attention to the practice recommended herein; moreover, I would beg leave to caution them from meeting matters of fact with opinions; for although no one man follows the plans herein recommended exactly as they are laid down before him, yet taking them as a whole, they are formed from both ancient practice and modern improvements; and in fact, every man in the habit of sowing wheat, may read in these pages some of his own daily proceedings recommended, united, certainly, with the most approved practice of others.

I must, therefore, be understood as rather selecting or compiling than inventing; let my readers, however, call it by what name they please, if they reap any benefit from the treatise, the great end of my writing it will be answered.

Indeed, the enemies to innovation have no reason to find any fault with me on the presumption of my interfering with old-established customs, and it is most likely that some readers

will object to my claiming any merit from this work on account of that very circumstance.

Men in general are so fond of being surprised and amused with what they read, that they feel greatly disappointed if they are put off with instruction. However, as the precautions necessary to guard against the diseases of wheat crops are so easily adopted, it may very much diminish any credit which would attach to the writer who pointed them out, compared to what he would be entitled to if he had interlarded his pages with some two or three dozen of curious receipts for new-invented pickles, which would, like certain quack medicines, derive all their merits from the use of the various ingredients being entirely unknown.

I must here content myself with laying before the reader, in a simple, unadorned, and unsophisticated form, the nature of those diseases which have raised the price of bread so high, and caused an alarming scarcity in some parts of Europe.

It frequently happens that nothing astonishes the mind more by its plainness and simplicity

when known, than that which caused most pains to investigate. These diseases which do so much injury to our wheat crops under the name of smut, rust, blight, and mildew, arise *either from the soil not possessing the ingredients necessary to mature and perfectly form a grain of wheat, or from the plant, whilst growing, being deficient of those physical powers which would enable it to extract from the soil and convert to its own support those ingredients necessary for perfecting its growth.*

This deficiency, though in appearance simple and easily remedied, is, notwithstanding, a subject of an abstruse and interesting nature, requiring more than a superficial glance into causes and effects, and more than a passing inquiry to explain; to understand it and to provide a remedy we must have recourse to analysis.

We must find out the various *materials* of which a grain of wheat is composed, and see how the soil in which wheat has or is about to be sown may be provided with those materials, or, if unprovided, how they can best be conveyed to it.

It will then be necessary that we take such

steps as will ensure to the growing wheat health and strength to enable it to derive that nourishment from the soil which we have provided for its support, and which health and strength are only to be insured by judiciously protecting its tender infancy.

Upon a right understanding of these two points depends the important consideration of supplying the population of these countries with bread independent of all the rest of the world; and I may be permitted to say that the attempt is deserving of every encouragement.

When we have made ourselves acquainted with the component parts of a grain of wheat, it is but a natural transition to endeavour to discover the component parts of the soil in which the wheat is to be sown, and to endeavour to supply that ingredient which is deficient. Can this knowledge of causes and effects be expected from a man who is entirely unqualified by education and habits for possessing it; and who holds all such knowledge in such utter contempt, that whoever was supposed by him to conduct the operations of his farm upon the ground-work of theory would be despised?

In every other profession, trade, art, or occupation, a previous knowledge of first principles is considered necessary to ensure a successful practice; but in agriculture, which more than almost any other science or pursuit requires extensive learning, all theory is rejected as useless.

It is much to be wished, that a different way of thinking could be brought about; and that men of liberal education and enlightened minds were encouraged to devote their time and talents to a pursuit, professionally, in which education and talents would have such ample field to range.

Let landholders consider the benefits and advantages they might derive from the assistance of those who were capable of directing the occupation of their estates to such crops as would best suit each peculiar description of soil; the selection and preparation of manures; the seasons for sowing; and many other material objects at present left to the doctrine of chances.—We should not then so frequently hear the weather and the season offered as a plea of justification for ignorance and stupidity.

I am more and more confirmed in my opinion by the events of every day, that this country will

never be in a proper state, as to its agriculture, until there shall be a regular system of education adopted for those who are to devote their lives to the profession of farming; and seminaries established in which they can have the advantage of enlightened professors who could direct their studies, superintend and guide their practice, and qualify them, by proper instruction, to conduct agriculture as a science, not practise it as an art. We want a regular college as well as for law, physic, divinity, or the veterinary profession; and if due consideration be given to the importance of their occupation and value in society, I must say agricultural professors would rank as high as those of any other science.

In the present state of things men are allowed to acquire their knowledge of this comprehensive and important science in any way they can; the consequence of which is, that we are exposed every year to the danger of something resembling scarcity, so far at least as paying extravagantly high for bread corn.

That the science of agriculture has been too much neglected, and, indeed, every art, however contemptible, preferred to it, drew from Colu-

mella a philippic, which, as it seems so applicable to my present purpose, I shall here beg leave to introduce.

" Satis mirari non possum, quod animi sibi quisque formatorem præceptoremque virtutis è cœtu sapientum arcessat; sola res rustica, quæ sine dubitatione proxima et quasi consanguinea sapientiæ est, tam discentibus egeat quam magistris. Adhuc enim scholas rhetorum, et geometrarum, musicorumque, vel quod magis mirandum est, contemptissimorum vitiorum officinas, gulosius condiendi cibos, et luxuriosius ferculà struendi, capitumque et capillorum concinnatores non solum esse audivi, sed et ipse vidi: agricolationis neque doctores, qui se profiterentur, neque discipulos cognovi: cum etiam si prædictarum artium professoribus civitas egeret, tamen, sicut apud priscos, florere posset respublica: nam sine ludicris artibus, atque etiam sine causidicis olim satis felices fuere, futuræque sunt urbes; at sine agricultoribus nec consistere mortales, nec ali posse, manifestum est."

Columella here expresses his surprise, that men should be so anxious to procure instruction in almost all arts and sciences; that schools should

be erected not only for teaching rhetoric, geometry, and music, but also for the most vile and contemptible purposes; whilst agriculture, without which no nation can flourish, or even exist, should be held in such little estimation, as to have neither public teachers nor pupils.

If the farming part of the community would give it a trial, if they would for once admit that practice may be improved by books, they would do a real benefit to the nation in encouraging the system recommended, provided it should be found to answer; there is no favor, no patronage sought for; practical examination is all I ask; and a candid report of the result. What a serious consideration for the reflecting mind to be told that we never grow wheat enough for our consumption, and that this year the produce is less than *one third of a crop!* and how necessary is investigation, when it shall be stated, that this deficiency arises solely from an imperfect practice in wheat management!

It is to be hoped, however, that among the various public-spirited societies and individuals so forward in promoting internal improvement, proper notice may be taken of this attempt, and suitable steps pursued to make it known.

On the analysis of wheat, it will be seen, that those qualities which are found to distinguish it in a particular manner from oats or barley are the *animal gluten and the starch;* it, therefore, becomes a question, *whether these two substances are formed in wheat from the ordinary materials which are sufficient to produce other grain,* or whether they require the soil in which wheat grows to possess an extra quantity of *certain primitive or distinct properties peculiar to the formation of gluten and starch,* and without which these soils are incapable of bringing wheat to maturity.

In order to obtain a clear explicit answer to this important question, and to satisfy the practical inquirer, it will be necessary to have recourse to the analysis of two different soils from one of which a perfect, and from the other an imperfect, sample of wheat had been produced. The portion of soil from whence the perfect wheat was produced, was found to consist of argill, silex, water, soluble carbon, carbonate of lime, and phosphate of lime, soda, oxid of iron, &c.

The other portion which had produced an imperfect grain, was found to consist of similar materials, *with the exception of phosphate of lime,*

which could only be found therein in very minute proportion. This earth on being sown with oats produced a fine plump heavy grain and full ear.

From this it would be natural to infer, that phosphate of lime is a necessary part of the soil in which wheat would grow to perfection, and although this particular has passed unnoticed by many celebrated philosophers, yet it is nevertheless the fact. Tessier even denies in positive terms, that any species of manure contributes to the formation of animal gluten, but more modern experiments have proved him to be mistaken.

Having stated that phosphate of lime is a necessary ingredient in any soil where wheat might be expected to grow to perfection; I now proceed to observe that the want of phosphate of lime is one chief cause of the smut and blight, for when the grain has arrived at that stage of its growth at which it would require the starch and animal gluten to be added in order to perfect its formation, *if it should not find the proper materials* for producing them in the soil, or *if the roots of the plants are defective in those parts* which would select the materials from the parent earth and convey them to the plants, a sickness or decline

in the crop instantly ensues: the grain, instead of continuing to grow to full maturity, becomes diseased, and as animalculæ abound in the atmosphere, they attack it exactly as flies will a dead carcass; they feed upon it, they propagate their species, they build their nests on the straw, they consume the inside of the half-formed grain and take up their lodging in the cavity, which being entirely filled with these inconceivably small tenants, resembling brown dust, have obtained the name of smut balls, emitting a peculiarly unpleasant smell when held near the nose.

Naturalists and experimentalists have ascertained, by the assistance of microscopes, that these smut balls, as they are called, are really receptacles of living creatures; and an accidental discovery of the fact was made by a gentleman in consequence of his having held them so near a candle as to create sensations of inconvenience from the heat, when the entire mass was seen removing from the vicinity of the flame.

The investigation of such minute matters may seem tedious and irrelevant; to some, indeed, they may appear to be entirely unconnected with the subject; but it is by attention and inquiry

into small causes that we are enabled to trace great effects.

It has been often asked as a question almost impossible of solution, why one part of an ear of corn shall be sound and the remainder only *smut balls?* or why, when three, four, or five stalks of wheat issue from one stool, one ear shall consist entirely of smut balls, and the remaining ears shall have sound grain? Some will bring forward this unexplained phenomenon as a proof that the damage has been done by atmospheric influence; they argue in this way, if the damage originated in the earth, one part of the plant must be as much injured as the remainder: it is impossible, say they, the thing could be otherwise; the same soil cannot produce sound and unsound ears; equally impossible is it, they continue, that the seed can be in fault, for if the seed had been unsound, it must have produced unsound plants, or if sound, perfect grain; let it be sound or unsound the produce could not be of both descriptions; *ergo*, the fault is neither in the soil nor in the seed: it then follows, as a natural inference, that the smut and blight, the rust and mildew, proceed from some noxious quality

in the air, over which, as we have no sort of controul, we cannot possibly remedy: thus the matter is given up in despair.

It is incontrovertibly true, that the majority of farmers have long ago decided the business in their own mind and come to this conclusion, that if steeping the seed, which should be well selccted from lands where there has not been any smut, will not protect their crops from injury nothing will.

This doctrine, almost every man who has heard the matter spoken of among cultivators, must have perceived generally to be prevalent.

Let my reader keep in his recollection the axiom I have laid down, *that those diseases which do so much injury to our wheat crops, under the name of smut, rust, blight, and mildew, arise either from the soil not possessing the ingredients necessary to mature and perfectly form a grain of wheat, or from the plant, whilst growing, being deficient of those physical powers which would enable it to extract from the soil, and convert to its own support those ingredients necessary for perfecting its growth.*

Let the practical farmer accustom his mind to

consider the above as deserving attention, and he will be led by insensible degrees to a system of practice which will better accord with common sense than placing all his dependance upon pickling the seed.

If I were asked why some grains were sound and perfect, whilst others in the same ear were only smut balls; and why, in a plant containing five stalks two shall have sound and perfect ears, and the other three produce smutty grain; my answer would be, that it proceeds from one or other of those causes stated in the above axiom; and thus it is to be explained.

A stalk of wheat is composed of a certain number of tubes, which communicate from the roots to the ear, and convey the necessary support as they receive it from them, the tap root supplying one part of the food to the plant, and the smaller roots furnishing others. Now, when the period in the growth of wheat has arrived, which requires a supply of phosphate of lime to complete the composition of the grain, those smaller roots are called upon to do their duty, should it so happen that the plant shall be unprovided with a *sufficient number* of those small roots to

furnish the necessary supply, or should they be impeded in their progress by coming in contact with imperfectly decayed weeds or grasses, or even the roots of wheat sown too thick, it follows, of course, that the necessary supply cannot be obtained by the growing plant; or should it so happen that the soil be unprovided with what is required, a failure must be the consequence and the plants unsupplied.

In either case the grains in the ears will be imperfect in a greater or less degree; some will be only partially, some entirely formed, and others so ill supplied as to fall into a state of immediate and rapid decay. Should the weather be dry and the influence of the sun strong enough, the grain only partially formed will become dry, hard, and shriveled; but should the season be moist, and the influence of the sun but small or casual, the imperfectly formed wheat is instantly attacked by animalculæ and speedily converted into smut balls.

Thus have I endeavoured, courteous reader, to account for that hitherto mysterious and apparently inexplicable peculiarity in wheat, and bring the same to correspond with the axiom above

stated. In the progress of this work you will be shewn how the deficiency of the plant arises, and enabled by simple and natural means to guard against such deficiency; so that, if what you have already read has not tired your patience, you may be prevailed upon to proceed further in this inquiry.

In order to ensure a plentiful crop of wheat, it is not barely sufficient that the ground shall have been well and judiciously enriched with suitable manure ;—I wish not only to make such preparations as will be thought sufficient in the general acceptation of the word, but, furthermore, to act in such a manner, that *no weather can injure the crop,* or prevent its coming to maturity.

Let not the incredulous reader start at such an assertion ; I am persuaded a bountiful providence has put it into our power to enjoy plenty in all seasons, without intending that a prevalence of cold weather in spring, answering many good purposes, or a continuance of rain in summer, equally necessary, should materially injure our wheat harvest.

I wish to render familiar to the capacity of every farmer, a practice which is calculated to

ensure him a good crop and the public a plentiful supply of bread.

The soil being properly prepared with every necessary ingredient, and the young wheat plant in a growing state, it must be particularly noticed that the *perfect formation of its root* is absolutely indispensable with its maturation. Should the root be *deficient in any of those ramifications which are intended for the support of the plant,* a corresponding deficiency must be the consequence, and smut, rust, blight or mildew will, most assuredly, attack the crop; and notwithstanding the proud, healthy appearance of wheat, and the luxuriant complection it may shew, we have too many fatal proofs that no dependance is to be placed in such fallacious symptoms.

This green and flourishing appearance, like the hectic of consumption, is, to the judicious observer, only cause of alarm and apprehension.

I have already stated, that the tap, or strong root, supports wheat with one part of its nourishment, and the lateral, or smaller roots, with others. Now, as in some seasons the wheat will be so forward in the growth as to become, what is called spindled, before winter, or, at least,

heavy and overloaded in the top, which state of forwardness the tap root is sufficient to maintain without the assistance of some other of the roots necessary for the support of the plant at a more advanced state of growth; the wind having power to agitate this plant, will so shake and disturb its lateral roots as they begin to shoot, that unless the soil shall be by some means pressed down close round them, they never can take hold. When this is the case, *a perfect and full formation of the root does not take place, and an imperfect formation of the grain is an unavoidable consequence; hence diseased and light crops follow.*

The farmer considers manuring and sowing wheat an operation with which he must be well acquainted, because he has been for so many years in the constant practice. The bailiff whom you hire, if you are an extensive landholder, to conduct your business, would be greatly hurt were you to ask him *if he understood the cultivation of wheat;* and yet I should be very much surprised to find one bailiff in the whole kingdom who really does.

To such people these instructions are particularly addressed, and to many of them, I fear, in vain.

When the seed wheat has been deposited in and *on* the land, for a great deal is never covered, it is in general left to its fate, if we except in some places, harrowing, hoeing, or rolling. Let us follow the crop then in its progress to maturity. We will suppose the tap fibre firmly rooted in the ground, and the season favourable to vegetation; we will go on to the time when the smaller roots begin to shoot out for the purpose of taking hold in the earth;—it frequently happens the surface of the land is so open that *these tender roots are situated in a temperature unfriendly to their growth;* the laws of nature require that they should be placed in a degree of heat equal and uniform.

If they are in a colder temperature they either do not grow at all, or they grow very imperfectly: for instance, perhaps one fourth, one third, one half, or three fourths, will become strong enough to take hold of the soil, and after extracting the necessary nourishment therefrom, convey it to the growing plant. Now, as nature is generally consistent in the vegetative parts of her process, and as she has furnished the wheat plants with those small roots for particular purposes, every

one fibre of which has its proper part allotted, it must follow, that in proportion as the plant is unprovided with the requisite number of its small roots, the grain will be unsupplied with nourishment.

From this it would appear, that in order to ensure a good crop of wheat, the land, *after sowing* ought to be *so finished,* that the temperature below the surface shall continue uniform to encourage the growth of the small roots, and to prevent the *danger which those roots are liable to in the spring from the evaporation caused by the sun.* It is well known, that all evaporation causes a decrease in temperature, producing the sensation we call cold; now in the spring, when the tender roots have begun to spread themselves, it frequently happens that a very hot sun will cause exhalations to rise from the soil; at the time this takes place the temperature is so much lowered by the caloric, or matter of heat, uniting with the water, to convert it into vapour, that the roots are so chilled as never to recover, in which case partial destruction is seen to ensue, the crop going off in patches, the blame whereof is generally laid upon the grub or wire worm.

When the injury done to the roots has not been so great as to entirely destroy the plants, they continue growing, and frequently shew strong, heavy straw, and full-sized ears, but the grain is sickly and withered.

Thus it appears, that unless the roots of the wheat are well protected, they are liable to injury, not only from the frost and cold winds in spring and winter, but from the influence of the sun in spring.

As to the supposition entertained by some people of the tender and succulent vessels of the plant situated *above* ground, and contained in the stalk, being burst by vernal frosts, that is entirely imaginary; no frost ever hurt the wheat plant *unless the root had been previously injured.*

I must also here mention another danger to which the roots of wheat are very liable in the best land, owing to their not being *properly* covered and protected: although they may grow, yet their growth is slow, they are puny and weak, and when vegetation comes on rapidly in spring, they are frequently so delicate as to be *surfeited* by the luxuriance of the soil in which they would have thriven and grown into an abundant crop

had their roots been sufficiently protected from injury in their infant state.

Will the explanation I have given sufficiently establish the truth of the axiom already stated, that smut, rust, blight, and mildew, are caused, *either from the soil not possessing those ingredients necessary to mature and perfectly form a grain of wheat, or from the plant, whilst growing, being deficient in those physical powers which would enable it to extract from the soil and convert to its own support those ingredients necessary for perfecting its growth?*

It is by no means unlikely, that the position will not be admitted by some of my readers; but as the affirmative, if once proved to their satisfaction, would for ever prevent the recurrence of bad crops and the present high price of bread, I have only to entreat, that whoever doubts the assumption, will give himself the trouble of inquiring, from any one who shall have tried it, the result of his practice. As to the sceptic making the trial himself, it would be, perhaps, too much to expect; nor is it to be wished, that a man who condemns the system would undertake its investigation with an unwilling mind, and in the face

of all his prejudices. As little is it to be wished, that his bailiff should be applied to, knowing as I do, how very averse this class of men has ever been to rceeive any instructions, particularly from books. The wise looks, the sly winks, and facetious nods, shew how cheap they hold every species of improvement.

It has been my particular study in this treatise to render myself as intelligible as language and the subject would admit of, and to give such instructions for wheat management, that the farmer may not mistake the principle. One thing I find it necessary to impress on every man's recollection: that is, the importance of a fine tilth; the land being free from weeds is certainly a material object, without which a good crop cannot be expcctcd; and as all agriculturists are supposed to be already aware of that point, there is the less necessity for insisting on it in this place.

But as the practice in most parts of England leads me to believe, that the necessity for a fine tilth is not fully understood, I may be excused dwelling on it.

It is impossible to secure the crop against the danger of smut, rust, blight, and mildew, unless

the soil has been so managed, that the surface can be rendered compact, and the porosity contracted, so as to keep the wheat roots at an equal temperature.

A rough uneven surface is, therefore, to be considered as proof of extreme bad management, and what every judicious cultivator ought to avoid.

If the land is left in great clods it is evident the roots of the wheat cannot be able to penetrate them in order to take such hold as they would require, of course they will be unequal to do the necessary offices towards maturing and perfecting the grain.

It also follows, as a matter of course, that the surface of the land, in that situation, cannot be reduced to that firm compact state which is necessary and, indeed, indispensable to secure the roots from the injury already stated.

And as a further reason for recommending the farmer to bestow more attention on leaving his wheat surface in a complete garden-like style, it is proper to observe, that when rough clods are not broken properly after the land has been dunged and limed, there is no manner of doubt that the

portion of the soil which is so very rough holds locked up a very considerable quantity of that manure which is chiefly desirable, as contributing to the perfection of wheat crops. In many parts of England and Ireland, men are employed at a certain price per acre to go over the wheat lands with spades, shovels, and other instruments, to break these rough clods small, and completely level the surface of the land, which is found to be of remarkable benefit to the crop, and could not be done, on some lands, in so effectual a way by the roller or any other implement yet invented.

CHAPTER VII.

Treats of lime.—Its application to land intended for wheat.—The quantity proper to be laid on.—The combination of lime with various acids useful in this instance.—Gypsum or sulphate of lime strongly recommended.—Without a due proportion of lime neither the straw nor grain of wheat can be formed.—Lime recommended to be laid on the floors of cattle stalls and yards.—Danger of entrusting tenants with power to lay out money in liming lands.—Good wheat cannot be produced without lime.

THE abundant supply of calcareous earth which the omnipotent hand has so plentifully distributed in every part of the globe, is a proof, that it was

intended to answer some great and extensively useful purposes, as providence does nothing in vain.

In the cultivation of wheat the importance of lime may be partly estimated by considering, that *without a due proportion of this earth, neither the straw nor ear can be brought to maturity.*

This invariable and unalterable law of nature is deserving the attention of every man concerned in agriculture; it will open his eyes to the necessity of using lime where the land shall stand in need of it; and I hope it will also enable him to improve his present system of operations, by rules deduced from nature; for though a vague and fortuitous practice resulting from ancient usage, has, in a manner established itself in the world, yet every day's result is enough to convince us that such practice is defective.

In recommending the use of lime, I shall have occasion to do what, it is to be feared, the reader may think me very fond of on all occasions, which is, to find fault with and condemn old customs. But truth obliges me to declare, that there is scarcely any operation connected with agriculture more improperly conducted than that of administering lime to land; whether re-

specting the quantity, the quality, the state of the lime at the time of using, or the manner of laying it on. The cheapness in some places, or the dearness in others, operate as obstacles to its use. People will say that lime is heating, and on soils where the substratum is lime-stone rock, it is of too burning a nature, when, in reality, from its mode of operation, when properly applied, it is of a different quality. There is another description of agriculturists who will acknowledge that lime is of use to some lands; but that the expense is so great they cannot afford it. Where the first objection is made, burnt lime may cost perhaps, three-halfpence the bushel; in the other case, where expense is complained of, the price is, perhaps, ten-pence.

But the most singular objection I ever heard made to the use of lime, was by a gentleman who presides over more than one society of agriculture, and issues premiums at his own expense to a considerable amount: on my remarking how much his land wanted lime, and how cheap he could burn it, "to tell you the truth," replied he, "I am no advocate for lime, as I am entirely ignorant of

its effects upon land, and cannot help thinking a great deal which has been said in its favour is fanciful."

One of the greatest mistakes committed in the application of lime, and which, on that account, I shall first take notice of in this place, is the custom, so very general, of laying it on lands in a *caustic state or hot from the kiln.* In almost every part of the kingdom where lime is used, they take it direct from the kiln and lay the stones (or shells as they are called in some places) out upon the land, leaving them to be slacked by the atmospheric moisture or by rain; it is hardly possible to imagine a more injurious operation to the land, the crop, or the farmer, notwithstanding which, it is daily and hourly practised. Fortunately for the mistaken cultivator, this error is rendered less dangerous than it would otherwise be, by another blunder which he is almost sure to commit, that is, ploughing down a great deal of this over-dose of caustic lime, and burying it far below the surface: had the whole of it been left near the top when laid on in the quantities sometimes used, it would be impossible for any

crop to have grown that season, when the lime had been only spread late in the spring.*

To make myself understood, and to give the practical farmer a more correct idea of the nature and properties of lime than he has at present, it will be well to give some explanation of the matter.

Lime, among other effects on lands when applied in a state of carbonate, that is, slacked and turned three, four, five, or six months, neutralizes and destroys the noxious qualities of any acid, which may have prevailed in the soil, and which encouraged the growth of particular weeds, moss, heath, &c. &c. By depriving the earth of that part of its composition in which these plants delight, they give place to a kind of herbage

* How dangerous it is sometimes to take instructions from the agricultural writers, who set about instructing practical farmers from theory alone. Doctor Anderson, who has exhibited himself to the public in a very conspicuous manner, recommends lime to be laid on in any quantity; he says, it is impossible to lay on *too much*. A more erroneous doctrine could not be preached; such instructions, implicitly followed by men who have no means of ascertaining their fallacy, have brought many excellent practices, as well as liming land, into disrepute.

more palatable to cattle and more profitable to the farmer: hence we can account for many surprising changes which some of my readers must have observed in land newly inclosed and limed; the whole surface of the ground seemed altered for the better, which is literally the case, as the nature of the soil had undergone a radical alteration. This is effected in some cases by a single, in others by a double decomposition, and substances are produced friendly to vegetation and contributing to the amelioration and improvement of the land. Among those new-formed substances may be classed phosphate of lime, gypsum, carbonate of lime, nitrate of lime, and fluate of lime, which are of considerable importance, not only to the growth and perfection of wheat, but some of them to every other description of grain, as well as to the mucilaginous and saccharine crops, such as grasses, cabbages, carrots, &c.

Lime also has the property of hastening the dissolution and putrefaction of all animal and vegetable matters, and of course converting them to manure; but if caustic lime be applied it seizes on the carbonaceous product of the decayed matter, and uniting with it, forms an insoluble compound

for a time of no sort of use in promoting vegetation. Lime imparts to the soil a very useful and necessary quality of *retaining* a quantity of moisture, either of rain or dew, to assist the strength and vigour of the growing plants.

It also possesses in its several combinations of carbonate, sulphate, phosphate, and nitrate, the power of *attracting* a very great proportion of moisture from the atmosphere in seasons when the growing crops would otherwise be in want of a supply, owing to a long continuance of dry weather; a proof that it is not of an heating quality. This moisture it will collect in the hottest and driest part of the summer or spring, in such quantities as will prevent any danger from drought.*

* As an instance of the capability which carbonate and sulphate of lime possess of attracting moisture and retaining it for the benefit of the growing crop, let the reader hold in recollection, that in the driest and hottest weather of summer, the evaporation of moisture from an acre of land, caused by the influence of the sun, will be 1600 gallons of water during the day; if, therefore, the surface of the soil shall have had a proper dressing of lime, the chief part of this moisture would be thereby retained for the benefit of

Gypsum*, or sulphate of lime, will speedily absorb its own weight of water from the atmosphere, which it administers to the growing vegetable as it can use it, and directly receives a fresh supply from the circumambient air, which, in like manner, it conveys to the plants, thus carrying on a constant succession of most useful and important operation for furnishing a supply of water to the crop. This property of gypsum has not, I fear, been sufficiently attended to by agricultural writers, as I do not recollect to have seen it noticed by any one whose

vegetation, the importance of which may be thus explained: Oxygen being absolutely necessary to the growth of plants, is absorbed in great quantities from the circumambient air by *moist earth*, and communicated to the growing crop, whilst *dry earth* is almost entirely deprived of the power of doing so; hence plants languish and die away when deprived of this principle so necessary to their existence.

* Gypsum, by resolving organic substances into a mucus, gives to the soil the property of absorbing oxygen for the purpose of promoting vegetation; for *pure earth*, it has been ascertained by Saussure, Bertholet, and other philosophers, has not the power of doing so; this is an important fact in vegetation, and will clear up much mystery in the doctrine of manures.

works have come in my way. They generally recommend the use of gypsum to farmers, as being the cause of very extraordinary fertility to land on which it has been applied. This they account for generally, by stating, that it accelerates putrefaction in a remarkable degree; and there seems to end the eulogium on this wonderfully useful production of nature. Its property of accelerating putrefaction is most useful, and entitles it to rank among the first of all fertilizing auxiliaries; and when applied in the proportion of from four to six bushels per acre, upon old grass land overrun with moss, or any vegetable matter in a state of incipient decay, it converts them into soluble carbon or manure, by a very quick process, thereby contributing to the fertility of the land and producing a supply of valuable rich dressing from a part of the exuviæ of the soil, which would be rather injurious to the growing crop, unless for the application of the gypsum. In short, it would be difficult to point out any thing which operates with such benefit to land in promoting the putrefaction of inert vegetable matter as the substance under consideration; roots of weeds, of grass, leaves of trees, or indeed

of every kind; all these things are directly converted into the pabulum or food of plants. It would, however, be wrong to omit dwelling, at the same time, on the other curious and valuable property of sulphate of lime or gypsum, because if farmers were to rest satisfied, under an impression that gypsum can only be applied to advantage upon grass land or land abounding with inert vegetable matter, they would deprive themselves of the assistance which might otherwise be obtained upon soils and crops where its powers would be felt with peculiar benefit, such I must consider the property, already mentioned, it possesses in an eminent degree, of *attracting moisture from the atmosphere* in the driest seasons, and under the most powerful sun, and directly communicating that moisture to whatever crop is growing there.

Whoever, therefore, properly appreciates the benefit of water in vegetation, will admit that any substance capable of yielding a constant supply thereof must rank high in the estimation of farmers. Gypsum may then fairly be considered as a most beneficial application on wheat lands.

How long since or where the use of gypsum, as a fertilizing dressing to land, may have been first known, I am unable to ascertain; I find the discovery in modern agriculture attributed to a Mr. Mayer, a German clergyman, and it must be allowed that such men are deserving of the gratitude of mankind. This substance is much used in various parts of Germany, Switzerland, France, and America, for dressing land, in all which places it is attended with very remarkable success, whilst in England its use is but limited, and as far as I have seen, becoming less every day. Why should the farmers of this kingdom reject a substance which those of other countries hold in high estimation from having experienced its good effects upon land?

I have, in the beginning of this chapter, stated, and wish it to be held in remembrance by all farmers, *that without a due proportion of lime, neither the straw nor grain of wheat can be perfectly formed;* in order, however, to render this doctrine more intelligible to practical men it will be as well to explain what connection there is between lime and a crop of wheat.

I have already stated, that the grain of wheat

required a certain quantity of the phosphate of lime, or in other words lime united with the phosphoric acid, in order to perfect its formation; from this phosphate of lime the animal gluten and starch are chiefly prepared by one of those secret and incomprehensible processes of nature, which we, perhaps, shall never be able to understand; it is a very remarkable circumstance, and deserves to be particularly noticed, that this *phosphate of lime*, which is found to constitute one of the ingredients in a grain of wheat, intended by providence for *our food*, is also known to form a very principal part of the human, as well as of other, bones; thus exhibiting one of the wonderful works of the great artificer, who has provided the calcareous earth in such abundance, which first of all becomes part of a grain of wheat, and being in the form of bread taken into the stomach, goes to the formation of our bones. The fluate of lime, or lime in conjunction with the fluoric acid, enters in a small proportion into the composition of a grain of wheat, from which it is selected by the unseen operations of the stomach, and forms the *enamel of the human teeth;* and what may be called a matter of curious

consideration is, that the *grain of wheat* intended for our food should be found to contain *phosphate and fluate* of lime so necessary for the *human frame,* whilst *the straw,* which is not intended for food, is found to contain *carbonate of lime only;* but as the grain could not be perfectly formed without phosphate and fluate of lime, so neither could the straw be strong or sufficient to carry the ear, unless it received a proper supply of the carbonate of lime from the earth. Thus have I endeavoured to explain the absolute necessity which exists for a *portion* of lime in the land to constitute a crop of wheat.

The operative farmer who may happen to read these pages will be inclined to suspect me of an intention to practise upon his credulity, or of a wish to exhibit the process of wheat management as something strangely mysterious, instead of endeavouring to simplify it to every capacity.

He will, perhaps, think his time thrown away in perusing unintelligible matter; however, as my object, really and truly, is to improve the present system of wheat culture, I consider the best way of accomplishing so desirable a purpose is, not only to state to him the absolute *necessity*

there is for his land possessing a proportion of lime, but to shew him *why* that lime is *necessary*, and in *what manner* he can most readily procure it in the different forms. For as to supposing that every farmer can patiently sit down and occupy his time on a chemical arrangement of lime in the different classes and proportions herein pointed out, it would be absurd to expect such a thing.

But having stated the combinations in which *lime must be found* in wheat perfectly formed, it will, perhaps, clear up any doubts or apprehensions raised in the breast of the farmer, if I shew him that the supply of lime in the state of carbonate, or slacked and turned for sixteen or eighteen weeks, can easily be made the means of procuring the other necessary additions.

The affinity which lime naturally has for carbonic acid, causes it to seize as much from the atmosphere or other surrounding objects, as will completely saturate it in a certain time; therefore when slacked and turned, it soon becomes impregnated with that matter. Gypsum, or sulphate of lime, is found native or ready formed by nature in large masses, and requires no other

operation than to be pulverized and applied on the surface.

Fluate of lime, or lime united with the fluoric acid, is also easily procured, because when carbonate of lime is laid on the land, a small proportion of it becomes saturated with the fluoric acid by some unknown process of nature, as the base of the acid has not been discovered. In its native state it is found in considerable quantity in Derbyshire, where it is known under the name of Derbyshire spar. I have never, however, heard that this has been applied to any agricultural purposes, for which it is certainly, as far as I can see, not quite necessary, unless in very small proportions.

The nitric acid united with lime, or nitrate of lime, is easily formed, for wherever cattle, sheep, &c. have dropped their excrement upon lime long slacked, or upon lime-stone gravel, it is speedily formed, and it is hardly necessary to say, that land upon which sheep or any other cattle have been folded is greatly benefited thereby. If farmers would get into the custom of laying chalk, or carbonate of lime, in heaps, for cattle to be folded in, or spread the floors of their stalls

with such materials, they would create a never-failing supply of superior dressing for their crops, wheat in particular.

I come now to speak of the phosphate of lime, which is so necessary an ingredient in the composition of a grain of wheat, that it actually cannot be formed without a proportion of this substance, even though *all the other materials* were present in abundance. And as the want of phosphate of lime is one of the chief causes of smut in the grain, and this want prevails mostly in wet seasons; it is my wish, and shall be my endeavour herein to explain, in as familiar terms as the subject will admit of, as much of the nature of the connection between the phosphoric acid and wheat as will enable the practical farmer to see the necessity, and comprehend the easiest method, of providing his land with this useful substance; he will perceive that it is a less difficult matter than he was heretofore aware of to guard against the very common and too frequent occurrence of a bad wheat crop.

This acid, the phosphoric, abounds in the animal and vegetable kingdoms, and can of course be obtained wherever animals and vegetables

are to be found; it also composes the chief part of whole mountains in the province of Estremadura in Spain, and I have reason to think it can be had in large quantities in Derbyshire, but this to remote farmers is of small interest. As it abounds in animal and vegetable substances, it cannot be considered a difficult acquisition to the farmer; almost all vegetables are found to contain it in greater or less proportions, both before and after the process of fermentation; muck, or farm-yard dung, abounds with it in great quantities. It is found to constitute a large proportion of the urine of all animals, not only in a disengaged state, but combined with ammonia, soda, and lime;—hence it will naturally suggest itself to the intelligent farmer, that he ought most carefully to preserve this excrementitious part of the cleaning of his stables as an invaluable assistant to his crops; and that he ought to appropriate as much of it as he can obtain to be put in the compost heaps preparing as a dressing for his *wheat lands;* in fact it is hardly to be supposed any man will neglect such a precautionary step, if the necessity of it should be admitted, but as I have seen many men inattentive

to things as apparently necessary, I am afraid to be too sanguine on the occasion; it is not sufficient that the farmer should preserve and apply this necessary material to his compost or muck heaps in a careless slovenly manner, as if he did not feel interested in the success; he should do it in such a way as to insure, as far as human precaution can do, that it shall not only be applied, but applied in such an effectual way, that the growing crop of wheat may be insured to receive the full benefit of the application so as to produce a perfect grain. Phosphoric acid applied to wheat lands mixed up in the usual way with muck may answer very well when the land shall not be greatly *drenched with rain*; but if the season prove even only moderately wet, *this acid is so easily soluble in water, that it is frequently carried away entirely out of the reach of the roots of corn;* and when wheat should receive the benefit of its assistance it is not to be had, of course the consequence is an imperfectly formed grain, and disease ensues.* This explanation

* In order, therefore, to prevent the escape and loss of the phosphoric acid, a proportion of carbonate of lime,

corresponds with the axiom which I wish to be held in remembrance; *that smut, rust, blight, and mildew, arise either from the soil not possessing the ingredients necessary to mature and perfectly form a grain of wheat, or from the plant, whilst growing, being deficient of those physical powers, which would enable it to extract from the soil and convert to its own support, those ingredients necessary for perfecting its growth.*

There seems to be a mistake, with regard to lime, universally prevalent. That it is in itself a manure, and that it enters into the composition of plants in *large quantities.* In conversing with farmers on this subject I have found this idea to prevail with all practical men, and even with many who ought to have known better, as they certainly had the means of acquiring such knowledge amply in their power. I, therefore, thought it necessary to explain something of the properties

or lime long slacked, should be mixed with the compost, and that proportion may vary from ten to twenty or thirty bushels per acre, or any quantity the farmer shall think proper to lay on as a top dressing. The lime will, in this case, retain the phosphoric acid until called upon by the roots of the plant to furnish it for the use of the grain.

of this earth relative to the purposes of agriculture, though, perhaps some of my readers may think the information not sufficiently full; but for a direction to practical purposes I am in hopes it will be found enough so. It is this mistaken idea of the nature of lime which prevents so many people from deriving that advantage which they might do from its use on land; and as many tenants have at one period and another taken land subject to conditions, in one case binding themselves to lay out a certain quantity of it upon each acre, in others binding their landlords to allow a proportion of rent, or five per cent. *for money laid out in liming*; I trust it may not be considered as unconnected with my subject to shew that such agreements are generally erroneous, in as much as, in most cases, neither landlord nor tenant knows the quantity which will confer a benefit on the soil without any superfluous expenditure; for where the article is very reasonable they lay on a great deal too much, and where it is dear, although the expense may deter them from such profusion, yet still the land would be as much benefited by administering this dressing with greater economy,

as if spread in large quantities; so that in all cases where the landlord is about entering into an obligation to entrust the tenant with the important concern of liming his lands, he should satisfy himself, in the first instance, whether the said tenant be qualified by previous knowledge for the undertaking—a species of information which the present state of agricultural forwardness has not rendered sufficiently general; and as it would, if better understood, be the means of extending improvements, the landed proprietor may form some idea of its value when he comes to learn, that, in some cases twenty acres might be limed to advantage with the quantity which is now laid upon one; and that by graduating the scale downwards according to the number of bushels laid on, he will find that, without any kind of exaggeration, where the smallest number is used, two acres may be usefully and profitably limed with what is at present spread on one.

There is also another circumstance relative to lime, which it is highly necessary to notice here: there is one species of it which abounds very much in Yorkshire and Leicestershire, and from its operating to destroy vegetation, the farmers

in those countries call it hot lime: some of it is found to contain nearly half its weight of magnesia. Many people imagine this description of lime to be totally unfit for land, but this is a great error: if used in very small proportions when compared to the other sort, it will be found highly useful, say from four to five or six quarters per acre; but it is to be observed, that in a variety of soils, *some will require more lime than others.*

If the reader shall have perused this chapter on lime with attention, he will have seen that wheat cannot be grown to maturity and fulness without a portion of it being in the land; but it is to be hoped he will, at the same time, be led to understand, that a much less quantity than what is usually applied will answer the purposes for which lime is intended.

As to its entering into the composition of vegetables, the proportion is so small, that were it to serve no other purpose in agriculture, much less might be applied to land than, from present practice, we can have any idea of. At the same time, that the fact of its being necessary for almost all vegetables would, when known, induce the farmer to administer a small portion on the

surface of his entire farm; and one *general* rule certainly applies to lime in all countries; that the true way to derive the greatest benefits from its use, is to let the application of it be repeated frequently in small quantities rather than lay on a heavy dose, as it is called, at once, not using any for years after; the great bulk thus spread is either ploughed in, or finds its way down, far from the surface, and forms a stratum below the roots of vegetables, lying an inert, unprofitable mass. If the practical farmer should doubt the absolute necessity of lime being near the surface to be of material benefit, he may be led to place some faith in the doctrine, when he shall be told that it can only enter into the composition of wheat or any vegetable in a state of complete solution, and that to render it soluble requires no less than three hundred parts of water to one of lime.

Having said thus much of lime, it is proper that I should, for the information of my readers, state that the same applies to other descriptions of calcareous matter, such as chalk and marl, with this difference, that as the lime contained in them is in a state of carbonate easily pulverized, they

can be laid on as they are dug out of the pit, without danger to the crops; but the same caution is necessary in respect to the quantity, for I have very frequently seen a coat of marl spread upon land in such profusion as to defeat the object of the farmer, by rendering the field for that year totally sterile; it is very true that for years after the fertility was almost miraculous, and would have been equally great the first season, had the proprietor only known something of the nature and properties of the substance he was using. It is well known to most who have heard of Hertfordshire, how celebrated that county has been for ages past on account of its fine wheat; this superiority is chiefly owing to the calcareous earth prevailing so much, and I would beg to impress on the mind of my reader, that if he would expect his land to produce a fine sample of wheat, to weigh heavy, he must apply a portion of lime as a top dressing to each crop, unless where the land already abounds with it naturally or artificially; and it is to be observed, that all soils of *superior* quality do contain lime in a considerable proportion.

The importance of lime to wheat crops is so

great, that no tenant ought to be permitted to sow that useful grain without giving a dressing of it. It is a matter in which the legislature of the country cannot, perhaps, properly interfere, but the case is totally different with the proprietors of estates; they might in most cases influence their tenantry, and when a trial or two had been made, the tenants themselves would become advocates for the measure, when they found as they would, that they reduced the risk of bad crops by this use of lime.

Laying calcareous earth on lands is, we will suppose, no novelty in agriculture, granted reader; the practice has been followed from time immemorial, and has been found highly beneficial, so much so, that in parts of Scotland, where the farmers have well earned the reputation of skilful and industrious, liming is considered a *sine qua non*—a thing which is absolutely indispensable; but when I am recommending its use on wheat lands, it is not merely telling in general terms, that it is a very excellent dressing for land, that it improves all soils for ages to come, and many other common-place observations, which are now almost universally known, if not

universally practised;—I state, and assume it as an axiom or self-evident fact, *that no land can be expected to produce a full crop of wheat unless a portion of lime, equal to the said crop, shall have been naturally or artificially applied.* Now if that shall prove to be the case, does it not become the bounden duty of every landlord to see that his tenants shall use a portion of lime on wheat lands; as much his duty as prohibiting the sale of hay or straw; regulating the rotation of crops; or the occurrence of naked fallows? If a landlord has a right, and exercises it, of interfering with, or directing, any proceeding of his tenant in one case, he, undoubtedly, may reserve a similar power in another. A tenant taking a farm on a lease cannot consider that a hardship which is a preliminary in the treaty, at least he ought not to subject himself to it if he does. Many landlords insist in their agreement upon a naked fallow, as already stated; this is unquestionably binding the tenant for a time to let his land lay idle, incurring thereby a certain portion of expense. The same landlord might with equal propriety say, part of my terms are, that on every acre of wheat land, one, two,

three, four, or five quarters of old slacked lime shall be laid. In fact, I consider, that a landlord who will, in future, permit wheat to be grown on lands not naturally possessing lime, without its being supplied by himself or his tenant, does the land a great and serious injury, and reduces it considerably in value; because, if in a farm of two hundred acres, forty acres shall be equal to the growth of an abundant crop of wheat, it naturally follows, that the average value of the farm must be greater than if only ten or twenty acres were fit for such a crop. And thus much I will venture to say, that there are but few arable farms of two hundred acres which may not be made capable of producing every year forty acres of excellent wheat.

I must here guard my readers against falling into an error, which in logic would be called a *non sequitur*; I have stated that no land can produce good wheat without its possessing a portion of lime or calcareous earth; but it is by no means my intention to be understood as holding out the idea, that lime will make any land produce it; there are other requisites to be attended to, and such as are equally important.

My principle of wheat management most certainly goes to this extent, *that all arable lands which will produce oats or barley may be made to yield good wheat;* but it is impossible for me to give a recipe, or code of instruction, applicable to every soil, nor indeed do I pretend to do so. The occupiers of farms must consider and compare circumstances and situations.

It has been my wish throughout the whole of this treatise, to strip the subject as much as possible of obscurity or affectation, particularly the trappings of pedantry, and what I am about mentioning may, perhaps, be considered as carrying my attempts at simplicity of means too far; but, however the information may be received, I find myself called upon as a faithful narrator of the economy of nature, to state that in applying lime to land, it is by no means a necessary and immutable ordination that it shall have been previously burnt. Lime-stone gravel, or the small chippings, and what lime burners in general consider the waste or refuse part of the quarries may be used on lands with nearly as great benefit as that which had been burnt; nor is the practice by any means unknown, singular,

or confined to a certain district; it is pursued in England, Wales, Scotland, and Ireland.

No doubt those who have never seen or heard of it before may consider it inferior to the practice they have followed; but farmers must not condemn every custom because they may not happen to be acquainted with it.

It is well known that chalk and marl are used in various places just as they are dug from the pits, and their effects are admitted to be fructifying in a high degree; every sort of land is improved by the application. Now, in some countries, where lime-stone can be had in abundance, of a soft kind, easily reducible to small gravel or chippings, it very frequently happens, that coals shall be dear; this is a bar to the application of lime. Let any man, in such a situation, make trial of one or two hundred bushels of the gravel to an acre of wheat land, and I will venture to say, the result will prove satisfactory.

But in order to forward the pulverizing of more stubborn lime-stone, a quantity exposed to the action of the frosts, if at all porous enough to admit of water, will, by the process of con-

gelation or freezing, be separated into parts sufficiently small for agricultural purposes.

The reader will be able from this statement to see at how small an expense lands may be limed in some districts, where the cost is considered equal to a prohibition.

That the application of unburnt lime-stone may be considered as no visionary scheme, it deserves to be known, that in a district of the county of Perth, in Scotland, called Rannoch, a machine was erected for pounding lime-stone small, for the purpose of spreading on land, as fuel was very dear, and burning lime made it expensive. The effects of the pounded lime on the land were admitted, by a number of judicious farmers who had repeatedly witnessed them, to be strikingly visible, sufficiently at all events to warrant the assertion, that powdered lime-stone is scarcely, if at all, inferior to that which has been burnt.

As, however, the process of pounding may be troublesome and expensive, I have been led to propose a method of reducing the stone into particles sufficiently small to answer every purpose accomplished by a machine:—let the farmer

draw a quantity of lime-stone, and manage, in some way, to have a portion of the roads, either public or private, near his land, constantly repaired with it, the scraping of which he might purchase from the overseers, as the case might be, or receive in lieu of his trouble and expenses for contributing to the repairs of the roads; this, if it were followed up with spirit, would be of important benefit to the farmers in more cases than one, and would, moreover, be the means of keeping the roads through the country in a constant state of repair, at a very trifling expense. Suppose the great turnpike roads were covered with lime-stone, the neighbouring farmers might be induced to purchase the drift at such a price as would be an object to them, and lower thereby the expenses of repairing the roads. Whether such a thing shall ever be put in practice from this suggestion, one point, however, is clear, that it may, and with very great benefit to the public at large.

As lime is to the cultivator of wheat an article of indispensable use, it will not be considered tedious in me to explain myself pretty freely on the subject of it, at least sufficiently so to give

to the practical farmer a clear understanding thereof.

It will readily be admitted by many of my readers, that one material point connected with liming land has not hitherto been explained in a satisfactory way, or rather, I might, perhaps, be allowed to say, that the instructions about laying on lime have been calculated to lead agriculturists into an error of no trifling magnitude, the persisting in which must cause a radical defect in the process, and to clear up this mistake shall be a part of my business in this treatise.

Ancient philosophers have conjectured, and the moderns have proved the fact, that all earths are metalic oxids, some of them in a state of nature contain a superabundance of acids of different kinds, the enumeration of which would, to the practical farmer, be only a useless undertaking. On lands of such a description, various kinds of weeds, heath, and other coarse matter, are found to predominate, and even after the most laborious and expensive cultivation, where lime has not been used, will usurp the place of every description of grass which the farmer shall have sown,

and the corn produced upon such land will never turn out what is called fine sample, nor properly filled in the grain. These effects are easily seen, although, in general, the causes are buried in obscurity. Upon lands of this description, I by all means recommend the occupier to lay a more liberal quantity of lime than what has been pointed out as sufficient to form a top dressing for wheat on soils which are not so highly impregnated with acids inimical to the growth of grain. Lime here may be truly called *an alterative*, and to accomplish this object, the quantity must be in proportion to the actual state of the land, and this can only be decided by proper examination; twenty, thirty, forty, fifty, up to one hundred quarters may be applied, but in very few instances would it be necessary to lay on so much as one hundred quarters on the first dressing; a much better plan would be to repeat the dose at a short interval of time, as no very sudden or violent application is adviseable in agricultural improvements; things to be done well should be done by degrees, and sufficient time allowed for the operations of nature to be effected.

Upon such lands as I am now treating of a mode of applying the lime should be adopted different from what is pursued in top dressing land for wheat. It should he laid on here in a caustic state, because it will operate sooner and more effectually to neutralize the peccant acids, and deprive the soil of the quality which is inimical to vegetation; but it ought to be thoroughly pulverized to answer the purpose, the more minute the particles the greater proportion of the soil will they come in contact with, and of course the more effectual will be their operation, and furthermore, when lime is intended as an alterative or to change the nature of the soil, as above stated, I would then recommend it to be used, not merely as a top dressing, but to be ploughed in with a very narrow, and, at the same time, shallow furrow, and thoroughly harrowed so as to become properly mixed and incorporated with the soil, as far at least as the roots of the corn are likely to penetrate.

Lime used in this way will, in a short time, entirely alter the nature of the land upon which it shall have been spread, and endow it with qualities which it never before possessed. Corn

grown thereon will be plumper, harder, thinner skinned, and a brighter colour, less liable to smut, rust, blight, and mildew, not so apt to be lodged, and will be found to ripen sooner, which is a circumstance of very great advantage, particularly in wet seasons.

Grass of a fine kind will take the place of those coarse bents and noxious weeds which formerly choaked up every thing; in short, the nature of the soil will be totally altered, and for ages to come it will retain this improved quality.

It is deserving of remark, that there are to be found many tracts of land through the kingdom which cannot be made to yield a good crop of either corn or grass, or indeed any thing useful, even with the application of dung in large quantities. Many people have attempted in vain to convert such land to beneficial purposes; both their dung and labour have been, however, thrown away and lost; paring and burning, with an application of lime in the manner above stated, would have answered the desired purpose, and the dung might have been reserved for ground which stood more in need of it.

All application of fertilizing composts upon

soils overcharged with acids of any description are only thrown away unless the operator shall add lime to the proceedings.

In many instances I have noticed a tenant, considered skilful and judicious, epithets oftentimes strangely misapplied, working away with all his might, ploughing, dunging, harrowing, sowing, and going through the usual routine of management on a new farm; but when he came to reap, grievous has been his disappointment to find the returns inadequate to rent and expenses; with all his skill and judgment he has been unable to comprehend the reason, and therefore incapable of applying the remedy; this every man has seen, who is in the habit of attending to farming operations; indeed, I have in my view just now a farm of some extent, upon which the tenant cannot grow a good sample of wheat, for no other reason than the land being in want of lime.

I might also state here as an illustration of what has been already mentioned of the benefit conferred by lime on wheat lands, that in some farms with which I am well acquainted, the proprietors have added considerably to their value by

the use of calcareous earth. One estate, indeed, of about three hundred and fifty acres, has been so much improved by the present occupier, who succeeded his father only six years ago, that the whole quantity of land, about twenty-five acres, allotted to wheat, has been increased to seventy-five, and as far as I can see there will be a farther addition very shortly, which encrease has been chiefly owing to a liberal use of lime.

This land had been chiefly coarse pasture with a little arable; during the summer season it carried a number of sheep and young cattle, such as might be expected from land in a state of nature. That part of the farm least productive from want of draining, and being overrun with coarse vegetables, has, by properly draining, burning, and liming, been converted into wheat land of a very superior description, to the extent of about fifty acres added to what was formerly occupied in that way.

In treating of lime, it may be a necessary caution to those who purchase and draw the materials from kilns at any considerable distance, to mention, that lime when fresh drawn from the kiln, weighs lighter by more than one half, than

it does when some time exposed to the atmosphere; therefore those who have it to carry will do well to consider, that the sooner they bring it home the lighter will be the load.

Of the effects of lime on wheat crops it may be unnecessary to say much to those who have been accustomed to the use of it, as to the luxuriance it communicates to them; but, at the same time, the information may be beneficial to others, and will serve to corroborate what has been stated in some part of this treatise. A gentleman, who had never much partiality for farming, found himself, by the failure of a tenant on his estate, in possession of a farm of about one hundred and sixty acres, the land in great want of draining, and very much exhausted by severe cropping and bad management. Having heard from a neighbouring farmer that he had found lime of great benefit to his land, which exactly joined this farm, he applied a top dressing of it to part of a field sown with wheat, and without detailing circumstances in a tedious narrative, he declared to me, that the land which had been limed, yielded nearly fourteen bushels more per acre, the grain being at the same time of a very superior

quality. Any of the old tenants on his estate will now cheerfully give a considerable advance of rent for this farm, as they have had a practical conviction of what it is capable of producing.

There is a part of the subject of lime, which, next to the actual application of the article on wheat lands, I consider deserving of explanation, because it is as yet by no means understood, nor have I seen it explained in any treatise which has fallen in my way, at least any attempt at explanation has been far from satisfactory or strictly reconcileable to science, therefore improper in practice; and, indeed, I must say that many writers on agricultural subjects have committed themselves greatly by laying down rules for others to go by, which they did not sufficiently understand themselves; this has been the case as much, perhaps, on the subject of lime, as on most others; I hope, at the same time, I shall not fall into a similar error myself, as it does a great deal of serious mischief, and usually brings customs good in themselves into disrepute.

The quantity of lime proper to be laid on at

one time as a dressing for wheat lands, I have endeavoured to point out to the reader.

The next thing which comes under consideration is, at what interval of time should the application of lime be repeated.

This I have slightly touched upon already, but on considering the subject, I think it will be by no means trespassing on the time of the reader to explain myself more fully on the occasion.

It has been already laid down as a rule, by agricultural writers, that land which has once been limed will not require a repetition of calcareous earth for a great number of years. That rule requires explanation, because it certainly would never answer for general adoption.

Where lime is intended *as an alterative,* and has been used as such with success, I admit that a repetition of it for the same purpose may not, perhaps, be necessary for several years; here, however, the connection of the rule above mentioned, undoubtedly ends.

When lime is intended to contribute to the soil that property which I have already stated is indispensably necessary to the formation and ma-

turation of a grain of wheat, and without which it cannot be brought to a state of maturity, then a different rule of conduct must be observed. Lime then becomes necessary to the very existence of a wheat crop, and I would go so far as to say, that I consider it as difficult to produce a full, healthy, and perfect crop of wheat, without a dressing of lime, as to grow the grain without having sown the seed.

Observe, I am to be understood as saying, *a full crop, free from smut, rust, blight, and mildew.* This is the object of the treatise. That wheat may be grown upon lands without such excellent preparation, we all know very well, but a half crop is not what I am endeavouring to obtain; already have we too certain a method of obtaining scanty and poor produce from the very finest description of soils; those who are satisfied with such, will, in all probability, persevere in the present system of management, whilst others will, perhaps, make trial of an improvement, which, it is to be hoped, they may find equal to the necessity of the occasion.

I would, therefore, by all means recommend, that a dressing of lime, *long slacked and finely*

pulverized, should be laid on wheat lands, as a top dressing, whenever the harrowing shall have been finished.

Lime, when applied to strong stiff clay for the purpose of breaking its tenacity and admitting of the operation of ploughing and harrowing with greater facility, must of course be laid on in larger quantities than when intended merely as a top dressing for wheat; and the number of bushels to be laid on, in this case, to each acre must be regulated by a proper consideration of the nature of the soil and the cheapness of the article itself.

The same may be said where it shall be applied on sandy soils, to *encrease* its tenacity and cause it to become firmer; here the application may be liberal, and if mixed with clay dug from a pit, will be found to improve the condition of light lands in a very remarkable degree.

In recommending an economical dressing of lime, chalk, or marl, it is by no means my intention to prohibit the application of it in much larger quantities; that is left entirely to the option of the farmer or proprietor, and where the article can be had very cheap, they may be, of course, more liberal than where the price has,

hitherto, almost amounted to a prohibition, when the idea was, that such great quantities must be applied in order to be of any benefit.

Some occupiers of land may, perhaps, be induced to make trial of lime on their wheat fields, when they find that it can be done in any country at a scale of expense within the compass of all farmers.

It is a custom very much practised in different parts of England, to have a heap of lime and earth collected at the gate of a field, under preparation for wheat, in the proportion of twenty bushels of the former and forty of the latter; the lime being thoroughly pulverized, they are intimately mixed together, and incorporated by repeated turnings, and spread on as top dressing to the wheat in spring with very great success. This surely is a cheap application *in any country;* but unless tenants shall be previously convinced of the absolute necessity which exists for lime being applied to wheat crops, they will be very tardy in the business, from an idea generally entertained by farmers, that liming land is of more benefit to the landlord than the tenant; and such is the disposition of that animal, called man, that some

occupiers of land, not only would do their landlord no direct benefit, but I am afraid would do him a direct injury if it lay in their power; such, for example, as permitting the destruction of gates, trees, and fences, if indulged with liberty to stay in their farm for a few weeks after quarter-day; burning straw in their house for fuel rather than leave it on the premises, with many other mischievous actions of a similar description which I have known practised. But, in order to ease their minds of the burthens, which doing any thing for the benefit of their landlord might cause some men to feel, they may rest assured that every bushel of lime, applied with judgment as top dressing to a wheat crop, will be paid for twenty times over by that said crop.

I have in this work had occasion to notice how little qualified the managers of estates and large farms were by education for a profession so scientific and important as agriculture; and as it was not my intention, by any means, to convey a censure on the men themselves for not knowing what they never had the means of learning, I think it but justice to state, that the very same remark is applicable, with its full force, to

a great multitude of farmers themselves, as well as to some proprietors of the soil; and when I am led to make such statement, it is for the purpose of opening the eyes of men to the contemplation of their own interest in the first instance, and the welfare of the nation in the next place; because had I stated the public benefit as the first consideration, it would be really putting the cart before the horse. It would well become the rulers of this empire, at a time when the spirit of the people seems alive to improvements, to establish some proper seminary for the regular education of youth in the various sciences and branches of philosophy, on which the welfare of agriculture is found to depend: such a measure would do immortal honour to the minister who adopted it, in which the adviser would also participate; it would do the country as much real benefit as any Hindoo method of education that ever was invented, and in fact, is quite as much wanted; nor do I see how a people, called wise and enlightened, can have an undisputed claim to the title, when they neglect the first and most important of all their temporal concerns; for it little matters to the great body of the people, how

trade may flourish, so long as the price of bread shall exceed the ordinary and proper bounds.

In order, therefore, to enable the landholders of Great Britain and Ireland to supply the population of these kingdoms with the first necessaries of life, I think greater attention should be paid to the education of those men who are entrusted with that important concern; and if the landed proprietors were to set about it in good earnest, we should soon see an establishment suited to the grandeur and dignity of a mighty empire. Perhaps the reader may suspect me of an intention to recommend myself for the professorship, but, in truth, I have no such stock of presumption, and mention the matter from a thorough conviction in my own mind that it is much wanted.

Experimental farms have been frequently recommended by agricultural writers, but, in my view of the question, an education founded on the true principles of science and philosophy, would be a better preparation for a farmer than any routine of management which could be taught on one farm, or by one man; this education would enable him who had received it to

convert every farm in the kingdom into an experimental one, and the operations of every agriculturist into lessons of instruction; he would be able to distinguish between good and bad husbandry, to suit his operations to the soil, the climate, and the season.

CHAPTER IX.

Necessity of thoroughly pulverizing the soil to ensure a good crop of wheat.—Naked fallow not necessary for the purpose.—Simplicity of any process in agriculture to be preferred.—Reasons why wheat land requires to have a compact firm surface.—Treading land with sheep recommended as a beneficial operation, most particularly so on light lands.—Treading prevents the fertility of the land being exhausted by the exhalations produced in very hot weather.—Rolling recommended.—Expense of a roll too much for poor farmers, who can, nevertheless, accomplish the object with sheep.—Treading

enables a man to finish more land for wheat with a few sheep than can be done by folding.

IN preparing lands for a wheat crop, it is necessary to observe, that a thorough and complete pulverizing of the soil may be considered absolutely necessary, and is, in fact, one of *the objects which we gain by naked fallowing* without our being sufficiently aware that it is so, or of the advantages which arise from it.

When the soil, particularly tenacious stiff clays, is not well broken, the small lateral roots of the wheat plant cannot penetrate sufficiently to acquire proper hold, of course they cannot perform their functions. This being more effectually done by a naked summer fallow (when the farmer tells himself he does it to destroy weeds) than in the usual course of husbandry, renders that mode of management so general. But if the same number of ploughings be given to land, with reasonable intervals, and two hoeing crops, such as tares and turnips, taken, I am well satisfied the result will do more to convince the judgment

than any essay or lecture, however argumentative or ingenious, which could be advanced on the subject. The beauty of a system seldom operates on the practical farmer; unacquainted with scientific principles, he is unequal to comprehend the inferences of the philosopher; they only serve to puzzle or bewilder him without convincing; and although I will readily admit that practice ought to be considered as more to be depended upon than theory alone; yet its operations are so tedious, that ages must pass away before improvements of consequence can be introduced, which would be entitled to recommendation from the result of mere practice. When we look round on the state of the crops every year of our lives, one suggestion forcibly rises in the mind, *that the ingenuity of man is strangely deficient,* or why should the cause of smut, rust, blight, and mildew, have escaped the investigation of *practical* men to this period of the cultivation of land; this is proof sufficiently plain, *that practice may be improved by theory.*

Having recommended the soil to be thoroughly pulverized, as preparatory for wheat, I am aware that some farmers will enter a caveat, and insist

that wheat likes a rough surface: let me, however, have the benefit of a hearing:—The object which the advocates for a soil to be somewhat rough to bear wheat, seek to gain by that roughness of surface, is *shelter and solidity*, that the roots may be kept warm and have a firm hold in the ground; and these are objects by that method *only partially obtained.* I have the same thing in view, and am well aware, that shelter as well as solidity is necessary to ensure a good wheat crop; in fact, without both it cannot be had; but as the *general practice* at present in use is, beyond all doubt, defective, it is my wish to introduce a system which would better answer the purpose: nor should the simplicity of the means, and their being in the power of every farmer, constitute any objection to the practice. I profess no superlative degree of wisdom, nor to raise the public estimation of my abilities by any mysterious or unheard of process; this would be the most likely way to astonish, but not to convince; it would resemble the shift of an illiterate quack, not the proceedings of a regular bred practitioner. Besides it never was the intention of providence to present insurmountable difficulties to the

attainment of the necessaries of life; any actual impediments which do present themselves arise from our own neglect and indolence, or from a blind attachment to customs without regarding whether they are good or bad.

It is a practice with some farmers to go over their wheat grounds in the spring with a light harrow, followed by a roller, moderately heavy, and those who have done so generally found their crop much benefited by the operation. They tell you it keeps the moisture in the soil and prevents the plant being injured by drought: all this is very true; but its good effects are by no means confined to these advantages, nor is the operation of the roller effectual or sufficiently executive of itself either in stiff clay, or lands of the lighter description; and therefore I shall endeavour to explain the benefits resulting from the practice *improved upon*, and that in so plain and, I trust, convincing a way, as to recommend it more strongly to the attention of practical farmers.

It has been already stated, that the roots of wheat require a certain temperature for their prosperity, and that this temperature should be equal and uniform.

It has been also stated, that a certain degree of solidity or staple is one of the indispensable properties of a wheat bed, to enable the roots to have a firm hold, which winds cannot disturb. Now, in order to obtain this *shelter* and *solidity*, I recommend the grower to proceed thus: *immediately* after the seed has been committed to the earth, if the *weather will permit*, I should have it gone over with a roller properly heavy, and laid as flat on the surface as can be done, after which I would drive a flock of sheep across the land until the whole had been well trodden and rendered solid; but should the state of the soil prohibit the use of the roller, the very earliest opportunity should be seized to drive the sheep up and down the land until they had trodden it quite firm; the wheat will then, in the usual time, shoot above the ground and shew itself. Should the frost be so severe as to loosen the surface, and by that means expose the young tender roots, it will be necessary to run the sheep over the crop again until it has been rendered sufficiently firm by their treading, and it is possible that the severity of the season may render it requisite to do so again before spring. Should

that be the case, however, the farmer may be satisfied that the trouble, which is but trifling, will be most amply repaid. In the month of April I would, by all means, recommend the flock to be driven once more over the field, when the crop may be considered in such a state as to be out of the reach of danger from cold checking the growth of the roots, which will soon become sufficiently strong to support the plant and supply it with nourishment in *any season, to bring the grain to mature and perfect formation.* By this treading of the surface, light, hollow lands, which in general do not carry heavy crops of wheat, owing to the plant not having sufficient strength of root to supply it with nourishment, will be rendered so tenacious and firm, that if previously enriched with proper dressing, their acreable produce may be very considerably increased, and their value brought to approximate soils of a higher annual rent.

Sufficient stress can never be laid on the use of treading land with sheep after the seed has been sown, in autumn, and again in the spring. The simplicity of the process may cause it to be held cheap; but the unprejudiced judicious cultivator

would find it one of the most beneficial operations in husbandry; without it wheat management is incomplete, and after the process it is almost a matter of certainty that the crop will be abundant.

The roller never will answer the purpose so effectually, as it must naturally pass over a large extent of surface too slightly, whilst the feet of the sheep, comprehending only a small space, press that into a compact firm form, which it is more certain to retain; besides, the treading of the horses is frequently injurious, and the expense is much greater. To those who would wish to convince themselves of the benefit which will result from treading the land after the seed, one trial will suffice, and even the advocates for rolling would be brought to admit the improvement which walking a flock of sheep over the land, after the horse roll, must make in the crop as to quantity and quality.

Many improvements in husbandry are neglected, and many inventions despised, because those who recommend them do not sufficiently explain how they operate; and practical farmers for want of properly understanding their uses, are unwilling

to adopt anything upon such unsatisfactory grounds.

It has, therefore, been my constant endeavour in this treatise, to give such reasons for what has been recommended, as I thought would go home to the judgment and understanding of operative agriculturists, leaving as little as possible to the imagination to illustrate. I shall, therefore, as a farther inducement to the practice of treading wheat with sheep, state, that besides those advantages already enumerated as resulting from the operation, it answers another great and important purpose with which the husbandman should be acquainted.

Modern discoveries have clearly ascertained that the pabulum or food of plants cannot enter into vegetable organization, except in an extremely attenuated state; it must be administered either in a gaseous or liquid form; even lime and silex can only unite in a state of solution, in both of which it is liable to be dissipated by evaporation, and carried off from the immediate vicinity of those plants for which it was intended. The application of manures in the usual way is calculated to furnish a considerable supply of the

carbonaceous principle in a state miscible in water, as well as convertible into carbonic acid gas by the absorption of oxygen from the atmosphere. When the soil has received this addition of manure, the farmer usually considers that he has done every thing necessary to render the land rich enough to carry an abundant crop of wheat; but this is in general laid on in such a way that a considerable portion of its nutritive qualities is carried off in a state of gas by the winds, as the dung is frequently left for days and weeks on the surface. But, perhaps, the cultivator will say he had his manure ploughed in directly after being spread; this, however, will not serve effectually to preserve all the good qualities of the manure, or, in other words, the carbonaceous principle, for the benefit of the crop then growing, as well as what is expected to follow, *unless the surface shall be well trodden and rendered solid by a flock of sheep having been driven over it;* because the earth is naturally porous, and when not trodden or rendered solid as described, admits of copious evaporation, not only when the sun shines, but, as atmospheric air is endowed with the property of holding aqueous vapours, in solution;

exhalations from the soil are more frequent than common observers have an idea of, so great, that in the driest summer's day an acre of land will yield, by evaporation, nearly two thousand gallons of water.

Now, if the man of inquisitive turn will employ his talents of observation and inquiry, they will lead him to pursue this investigation far enough to discover that *the treading of land with sheep,* as already recommended, would most effectually prevent this wasteful exhalation of the carbonaceous principle from the earth where it had been deposited; it would preserve for the growing plant the pabulum, or food necessary for perfecting its formation: he would find that danger was to be apprehended, not from unknown, imaginary, or unexplained causes, which could not be guarded against, from frosts, rains, drought, electricity, or bad seed; but from one or other of those two defects so frequently repeated, either the soil not possessing the ingredients necessary to mature and perfectly form a grain of wheat, or that the plant, whilst growing, was deficient of those physical powers which would enable it to extract from the soil, and

convert to its own support, those ingredients necessary for its perfect formation. It would be familiar and intelligible to his judgment and recollection, *that if the land be properly prepared and its tillage finished in a masterly way,* not one season in twenty would a bad wheat crop be seen.

He would know that phosphoric acid, united with lime, which contribute to the formation of starch and animal gluten in wheat, is very easy of solution in water, and that in very rainy weather it is carried off, united with water, in a state of vapour, or washed so deep into the soil as to be beyond the reach of the roots, and at that particular period of time when the want of this necessary material is felt by the ear in blossom, disease attacks it in the form of smut, rust, blight, or mildew; and knowing thus much, he would guard against excessive exhalation and exhaustion by that simple and effectual operation which would prevent both: viz. having his wheat land trodden firm with sheep.

If, therefore, my explanation has been sufficiently clear and satisfactory on this part of the subject, every grower of wheat will be able to

guard against bad crops, not by any fanciful or experimental process as heretofore recommended; but by a system founded upon the unerring and immutable laws of nature. The practical farmer can soon satisfy himself by trial; when he shall once have ascertained the fact, it will be in his power to stamp the credit of his own recommendation upon the system.

Having mentioned the roller as an implement very useful to the grower of wheat, I must beg leave to observe that the operation of treading with sheep will, in the majority of lands, especially those of a light description, ensure a plentiful produce of grain without any rolling, and particularly on those hilly or uneven surfaces, where, perhaps, the roller could not be brought into action; besides, there are many farmers who would be deterred by the expense of such an article, whatever advantages its use might offer; and in many cases small occupiers could not afford the first cost of one, therefore those who are in that situation may rest satisfied upon the point.

Every improvement which machinery or implements of any description are really calculated to

effect, ought to be taken notice of and recommended; but at the same time we should hold in recollection, that men of small confined capital and means are debarred from these advantages, and therefore, it becomes the duty of those who attempt to convey instruction on subjects of rural economy, to address their remarks to the needy and necessitous, who stand in as much want of them for improving their circumstances and situation as any class of men.

If the small farmers in the remote parts of Scotland, Wales, and Ireland, were enabled to grow as much as a quarter or half an acre of wheat to each family, their condition would be materially improved and their situation ameliorated. The very formation and texture of their bodies would be bettered by such diet, for although we, perhaps, on cursorily viewing the matter, are apt to suppose that the natural and universal predilection for wheaten bread is the capricious whim of fancy, yet an attentive examination will convince us that providence has, with unerring wisdom, implanted in the whole human race a particular relish and appetite for this species of food, of which we never tire, on

account of its possessing very remarkable qualities for the growth and formation of certain parts of the human body, which neither oats nor barley furnish in an equal proportion; and without taking up the reader's time with a dissertation on the subject, let it suffice to say, that *lime*, in various combinations, is the chief ingredient which the omnipotent artificer employs in the great work of forming the whole human frame. Almost every person must have remarked the predilection shewn by children for wheaten bread; a predilection almost without exception, and yet dry wheaten bread would appear to adults but an insipid diet; children, however, give it the preference to almost every thing else for a constancy. This is a particular ordination of providence; for as no kind of food taken into the stomach furnishes such a quantity of calcareous matter as wheat, and as the growth of children requires a constant supply to keep the bones furnished with such a necessary material, it must be evident that bread made from wheaten flour is the best calculated for the growth and nourishment of the human body.

There arises in this place a suggestion relating

to the health of men employed in work requiring great bodily labour and continual exertions of the sinews, which extends itself to the soldiers composing our army, and the sailors manning our fleets, and is of too much consequence to be thrust in here as an episode; but which, nevertheless, I will take an early opportunity of exhibiting to the view of those who are entrusted with the care of these gallant men.

In the culture of wheat, farmers universally look to select lands, naturally strong and tenacious. In such the roots have a firmer hold, and more equal temperature; the carbonaceous principle and other necessary ingredients are retained with more pertinacity for the support of the crop; but let my readers at the same time hold in recollection, that light lands, at present considered unfit to bear wheat, may, by such management as I have pointed out, be so changed in their nature as to carry that useful grain in very abundant quantities. This would be a point of consequence gained by the individual and the public, and that it is practicable every man may have recourse to the fact itself for proof.

Folding sheep has been a system for ages,

indeed, in some parts as far back as tradition itself can carry us; but as folding is an operation naturally very slow, and on an extensive farm, requiring a numerous stock, I recommend driving over the land as a proceeding much more complete for general purposes, without, however, in the slightest degree, intending to infringe upon the custom of folding, which I consider as a most excellent plan when properly conducted.

CHAPTER X.

Improvement of lands by superior management proved to be of as much consequence to the tenant as the landlord.—The increased growth of wheat a measure to be gained by such improvement.—Waste lands may be reclaimed at much less expense than what is generally incurred.—The author promises a treatise on manure which will enable farmers to encrease the fertility of their lands without the aid of live stock.

THE discoveries in chemistry and natural philosophy made within the last few years have certainly not been attended with those benefits to agriculture that might naturally be expected, and which the great increase in our population appears to require. The fact is so, but to account for it is

somewhat difficult. One circumstance appears to me to have retarded so desirable a consummation, and that is the very few practical men who take the pains of laying down as a rule for their proceedings a well-regulated theory; from this I am inclined to suspect arises the vague and uncertain practice of agriculture throughout the United Kingdom; nor is it to be expected that great or general improvements can take place until the theorists shall have had more practice, or practical men have studied theory with more attention. Of all the mistakes committed in the practical part, none is, perhaps, more universal or more injurious in its consequences, than *the want of selection in soils, and adapting the crops, for which each sort of land is best fitted, to that land.* Whoever has travelled through England, Ireland, Scotland, and Wales, and viewed the farms with a judicious eye, must have observed that this error is committed in every estate through the kingdom. It is not only injurious to the tenant, but absolutely diminishes the value of the rent to as much as a fourth of what the land is really worth, and in the end the public must suffer, as is the case in the necessity we are under of importing so much landed produce from

other countries: for instance, all sorts of provisions, corn, butter, beef, pork, &c. tallow, hemp, honey, bees' wax, silk, oil, wool, flax, flax seed, oil cake, &c. &c.; all which the farms of this country are capable of furnishing to the wants of the community, if the *occupiers* were put into a proper method of doing their business. Nay, it is a disgrace to a civilized state to see the backwardness of the people in many of those things which are incompatible with our wants and necessities; and what is it all owing to? The answer to this query would convey so general a censure, that I should wish to decline it. Let every man look into his own or his neighbour's proceedings, and he must at once find an explanation perfectly suitable: whole farms of great extent which would pay three, four, five, or six pounds per acre, under a proper rotation of crops and judicious management, are let at fifteen to thirty-five, forty, or fifty shillings, and at that rent considered dear by the tenants; the fact is really so notorious, that no man ought to doubt it. I shall here give a scale of the difference in value between farms as they are now let and what they ought to produce.

I will instance a farm of two hundred acres, divided into several lots, as follows:—

	£
200 acres, rent £4 per acre - -	800
Expenses - - - - - - - - -	600
Living and education of family -	300
	1700

PRODUCE.

ACRES	*PER ACRE*	£
10 - - - - -	£12 - - - - -	120
10 - - - - - -	15 - - - - -	150
10 - - - - - -	20 - - - - -	200
10 - - - - - -	20 - - - - -	200
10 - - - - - -	10 - - - -	100
10 - - - - - -	12 - - - - -	120
40 - - - - - -	10 - - - - -	400
60 - - - - - -	12 - - - - -	720
20 - - - - - -	10 - - - - -	200
20 - - - - - -	5 - - - - -	100
		2310
Deduct charges as above - -		1700
		610

Leaving a profit of £610 to the farmer, after maintaining, clothing, and educating his family for the year.

If you would wish to see how that farm did produce under the usual system, look at the actual state of many tracts of land in various parts of the kingdom, and you will see it so different as to excite considerable surprise that some alteration is not made: but you shall see the account of the same farm under former management.

It is, however, to be observed that the farm in question was considered by the original tenant, and under the old system of management, as dear at the then rent, in which I believe he was perfectly right. It is literally the case with three-fourths of the farms in the kingdom, and always has been so. Look at every piece of ground in the hands of a judicious gardener, and see what he can make it produce; look at the same extent of land, similar in quality, under a different system, and the thing is explained: look at the value of open field and compare it with enclosed lands: in short, let us pay attention to the effects of industry and ingenuity.

Rent and returns of the same farm of two hundred acres of land managed in the usual mode, at a customary rent, the tenant left to the exertion of his own judgment and discretion.

	£
200 acres, rent 18s. per acre - -	180
Expenses - - - - - - - - - -	150
Cost of living and education of family	80
	410

PRODUCE.

ACRES	*PER ACRE*	£
150 - - - - -	£3 - - - - -	450
50 - - - - - -	1 - - - - -	50
		500
Deduct charges as above - -		410
		90

Leaving a surplus of £90 to the farmer.

Now, if any person who is in the habit of witnessing farming operations, and the improvements which a *proper selection of crops* and selection of ground will bring about in the value of land, he will find that *the encreased profit of*

the tenant might and would regularly keep pace with the addition to the landlord's income, and that the public must be benefited in proportion. Let him suppose to himself the comforts which a farmer and his family enjoy on an expenditure of £300 compared with that of £80; and he must admit the improvement to be still more in favour of the tenant.

But there is no necessity for commenting upon a fact which carries conviction along with it, and when the landlord and tenant can view their mutual advantage in doing so, we may expect to see them set about the improvement of the lands; but they must go hand in hand; it is in vain to expect men pulling different ways can be sincere towards each other.

The tenant would very soon see that he would have it in his power to live better and save more money by changing his present practice for a more improved one. As things are now regulated, the profits of a farm paid to the landlord arising from any advance of rent, are considered as so much absolute loss to tenants, and which they, of course, pay with reluctance; but if improvements of a lasting nature were introduced, their eyes

would be opened, and the true state of the case would be found to give the farmer a considerable degree of interest in every improvement made in the system of operations, presuming, of course, liberality on the part of the proprietor.

It is to be observed, that the improvement of this farm was not confined to the encreased annual value derived to either landlord or tenant. The public was benefited in a proportion equal to the others, because part of the improved mode of culture was the growth of forty acres of excellent wheat every year, whilst it never yielded above ten on the old system, and in general not more than five, of only a middling quality; and let me be understood always, when speaking of an improved system of farming, as meaning to include a very great increase in the quantity of wheat which can be grown by a rotation of crops, manuring more land, and superceding the necessity of fallows in the usual way.

For instance, having crops fed off saves the dung for some other purpose, and prepares the land equally well for wheat; this dung would do for potatoes, cabbages, &c. &c.

And as green food, such as tares, rape, turnips,

clover, &c. &c. enables the farmer to keep more live stock, and that the droppings of animals cause land to yield wheat of very superior quality; it must be allowed that a system of management which went to accomplish these two objects must be considered a great improvement in the present practice. There is one thing to be observed in speaking of improvement, that the first step towards it may be fairly considered, the *capability of supporting live stock* in good condition through the winter and spring. When a farmer is able, by any alteration in his mode of management, to maintain a large stock of animals, particularly sheep, he may naturally expect that the condition of his lands will be benefited in proportion; and that he will have it in his power to grow wheat and barley in greater quantities, and of superior quality; so that, in whatever shape improvement is sought for, an increase in the growth of wheat may be fairly considered as a material part thereof.

It is on this principle of growing hoeing crops that I propose their substitution instead of a naked fallow, and as the practice has succeeded with myself as well as with many others who

have followed it, I may venture, with submission to the opinion of older and abler heads, to suggest that a trial can be attended with no sort of risk to any landholder. Arguments are unnecessary in this instance; facts will soon be furnished to substantiate the plan recommended, and in every instance where a good winter crop is to be had, it will, if well managed, pay any reasonable rent, as well as manure the ground for spring; and as an inducement to occupiers to proceed in this way, I can venture to assure them, that on many farms the winter crop pays the rent.

If every landholder in England would take seriously into consideration the benefit he would do his country, and the addition he might make to his own income, by introducing a proper system of cultivation amongst his tenantry, he would set to work in earnest. Systems, or general instructions, are little to be relied upon; an examination into the state of the land must be entered into, and this should be done, not by consulting men who are incapable of giving advice worth attending to, but by ascertaining the local and natural advantages of the lands. When that is

done, the owner will not stand in need of the opinions of others, he can then act independantly of his bailiff or his tenants. It may be some encouragement to land-owners to be told, that the knowledge here recommended is by no means difficult of attainment; indeed it is quite the reverse, *and if sought for can be had.* Lands under the best and most approved mode of management may be still made more valuable than they are at present. Lands under a less excellent course of husbandry will naturally admit of much greater improvement and increase in their returns; but lands, at present in a state of nature, afford temptations to the owner which are little less than finding a treasure hidden in the earth.

I have known many instances, however, where waste lands have been reclaimed at the enormous expense of £80 per acre. This a man might say was purchasing them too dear, but it may be some comfort to those who have improvements in view, to be told, that in many instances such expense arises from *injudicious management,* and might not only be avoided altogether, but in reality, the outlaying of the first year be all paid by the

first crop, and a surplus left in the pocket. In no operation connected with agriculture does the operator stand more in need of a well-regulated theory than in the reclaiming and improving large tracts of unoccupied ground. It is one of the nicest operations which the industry of man ever attempted, and yet no one is conducted in a more slovenly or imperfect manner. The proprietor is, in most cases, under a necessity of leaving it entirely to men who are unacquainted with every principle upon which it should be undertaken, and who are perfectly unconcerned about the issue, looking only to the quantum of emolument which they themselves shall receive. The millions of money which have been thus wastefully, ignorantly, and dishonestly squandered, must have discouraged men of enterprize from prosecuting improvements, which, instead of increasing, would materially curtail their property. This is to be lamented, and can only be remedied by the simple precaution stated already, of the proprietor making himself well acquainted with the natural advantages and capabilities of his estate, and what sort of crop it is calculated to yield, with the greatest benefit to himself, and

least injury to the land. This previous knowledge would save many a man from the regret attending expensive and extravagant improvements, and would operate as an inducement to the prosecution of measures calculated for the benefit of his family.

I would, therefore, by all means, recommend the cultivator of waste or newly broken up lands to endeavour at having a portion of them put in order for wheat, if he expects they should pay for cost of reclaiming; and as an encouragement, let him hold in recollection, that such lands are, if properly managed, calculated to bear a crop free from those diseases which in general do so much injury.

The slovenly, injudicious practice which many people pursue in breaking up and cropping greensward can never be sufficiently condemned. It would occupy a separate treatise of great extent to detail the errors which have been committed for ages past in that department of farming, and to lead the operator into a judicious, well-digested plan of proceeding; but as it is my object here to confine myself, as much as can be done, to the improved and extended cultivation of wheat,

I shall content myself with observing generally, that those who are breaking up old turf should hold in recollection, that by the process of paring and burning, in the way herein recommended, they may in the first year have a wheat crop of very superior quality from such lands on the whole extent of surface; and furthermore, they may keep their lands in such a state of heart, as it is called, or fertility, that a considerable portion may be cropped every year with this useful grain at a small expense. Old turf or greensward which has become what farmers term hidebound, and overrun with bent and coarse grass and moss, ought, by all means, to be broken up. The common practice as I have observed in another place is ploughing in the sod and sowing oats. If tenants will obstinately pursue such erroneous practice in defiance of every thing recommended ages back by the best authority, it becomes the duty of landlords to interfere, particularly in a case like this; and such is the obstinacy, the perverse disposition of some men, that no temptation would be strong enough to induce them to depart from a custom they had followed, notwithstanding the daily and hourly

proofs of its absurdity. Farmers who have witnessed the destruction of crops by predatory insects upon old sward land, *ploughed down,* for four or five years after having been broken up, might be convinced that such a practice was wrong; but that attachment to old customs which I have had occasion to lament in many instances, shuts the door against any sort of improvement. How different would be the situation of the land and the profits of the farmer by following the practice recommended in this work of paring and burning, followed by turnips and wheat. Among the numerous advantages arising from paring and burning must be considered the facility it affords of laying them down directly to grass, should the occupier be inclined so to do.

Whoever has observed a field of wheat, in the management of which the farmer has exerted every species of industry and ingenuity within his means or ability, well prepared by fallow, by manure, by cleaning, and, in short, done what is called well; whoever, I say, has watched the progress of the crop, seen it flourish, shoot into ear, blossom, and apparently fill well in the grain,

and then considered the danger of smut gone by, has, after all, not unfrequently been grievously disappointed by witnessing his hopes blasted by the crop appearing in a short time struck from one end of the field to the other with smut in the ear, rust in the straw, and, finally, destruction to the whole. In such cases a man looks round him for the cause, but too frequently in vain: such calamity scarcely ever proceeds from one alone, many things conspire to produce such fatal results. Very frequently wheat sown upon land broken up a year or two from turf in the improper way taken notice of here, is destroyed by the old roots of the grass preventing the roots of the wheat performing their functions; in some cases the land lies so light and hollow, that the wheat never has been properly bedded, therefore cannot come to maturity; at other times myriads of insects prey upon and cut off the straw in patches; and to carry the investigation further, sometimes all these unite in one common cause of destruction. When the land lies very hollow, and the wheat has been harrowed in, a brisk gale of wind will so shake and disturb the roots that they never afterwards can perform their functions;

this, of course, will be followed by manifest and serious injury to the crop: but when the land lies light naturally, if the seed had been ploughed in and the ground well rolled and trodden with sheep, the danger from winds would be entirely done away.

If, therefore, the reader should inquire what connection there is between my instructions about breaking up old greensward land and the improved culture of wheat, I answer, that they are most intimately connected, because, instead of having two bad crops of oats by improper management, followed by wheat equally unproductive, the occupier might begin with an abundant return of wheat the very first season, and continue a succession of produce equally beneficial to the expiration of his lease.

Perhaps I shall be excused for introducing in this place an anecdote of a farm which I know to be a fact:—it consisted of one hundred and sixty acres, and was, when the lease expired by the tenant's death, offered for hire: the highest bidding was twenty-two shillings and sixpence. The owner had an extensive estate in the same country, which might be called of a similar

description and value, so that the letting of this farm set a rate upon the remainder. I advised him to take it into his own occupation, which he did; I then gave him a paper of instructions by which he was to proceed; these he followed, and without being one shilling out of pocket, after making some lasting improvements on the land, he let this farm in eighteen months on a fourteen years' lease for three guineas to the very person who would not, in its former state, offer more than twenty-two shillings and sixpence. I know at this moment a small estate which the owner occupies, and on which he can barely contrive to live in a poor way; but this estate is well worth twelve hundred pounds per annum. I have seen in Wales large tracts of land, capable of producing excellent wheat, in a state of nature, and likely to remain so, because the owners will not give themselves the trouble of looking into their affairs, and yet we are paying the subjects of other countries a rent for millions of acres. Oh! shame, shame! arouse men of Britain from the state of indolence, yolk your teams, and go a-field.

Those who are alive to improvements in agri-

culture must have frequently observed a farm, the lease of which had expired, to be let, and from the state of poverty and foulness in which the tenant left it, very few men would venture on the occupation without having the land either at an under-rate or being allowed a considerable reduction on the two first years' rent; every day we see such cases before us. When a farm has been exhausted and worn out by repeated croppings and no manuring, the expense and time necessary to bring it into a state of fertility bear very hard upon the tenant; this is entirely owing to want of theory, or more properly speaking, want of knowledge on the part of the tenant. If the occupier of a farm was a little better acquainted with the connection between cause and effect, he would find himself in possession of resources upon even the most exhausted land, that would enable him to go to work with more profit to himself and justice to the farm. I have often witnessed the operation of fallowing in such cases, and an entire year of unproductive wasteful expenditure to prepare the land for a crop, which after all did not pay above half the cost of growing it. The first consideration on taking possession of

land in that state is provender for your horses, the next, manure for the soil; here I find the ingenuity of man strangely deficient, and in order to facilitate improvements, I do purpose, if this work should be well received by the public, to lay down in the second volume a set of rules for the guidance of the farming body, which I trust will be found of service, and these rules they may rely upon as arising out of practice the most improved and best conducted; to do so here would swell the work to an unreasonable size and retard its appearance, which if it ever will be of use, this is surely the time.

On manures, particularly, it is my intention to enlarge so as to put it into the power of every farmer to prepare fertilizing compost of a very superior description without the help of stock; a desideratum in agriculture, the want of which is generally and severely felt.

CHAPTER XI.

On the drill husbandry as it relates to wheat, both in producing a heavy grain, preventing smut, rust, blight, and mildew, hindering the crop being beaten down and lodged by rain and wind, or injured by wet weather, whilst advancing from the bloom to ripeness.

I HAVE stated in a former chapter that our system of wheat management through the entire kingdom is *imperfect,* and I have given as a proof, the frequency of bad crops, or more properly speaking, the paucity of good. My readers will have discovered before arriving at this part of the work, that the imperfection is not owing to one or two errors in the practice, but to

different improper modes pursued in various places; and here it is to be observed that in almost every district, and by every individual, a radical mistake is prevalent in putting the seed into the ground. Farmers, in general, are of opinion, that the produce can never be great unless the crop be very thick when it begins to grow, and the consequence of this their opinion is, that in order to have the crop thick they consider it indispensable to sow a considerable quantity of grain, supporting their opinion by an old adage, that "if you sow thin you will never reap thick." The fallacy of this doctrine, however, may be seen, if not from my explanation, from any person taking the trouble of making trial of the two modes of practice, *thick and thin sowing*. If, in going over a farm, you observe the young wheat coming up very thick, and covering the ground similar to grass, and should remark to the farmer as I have frequently done, that it was too thick, he would directly reply, we shall not find it so at shearing time. Certainly nothing is more likely, because that very circumstance of its too great luxuriance is the cause of the falling off, and many fine crops have been nearly destroyed by standing too

thick on the ground. Notwithstanding that, occupiers of land have been disappointed in their expectations year after year, from these over-luxuriant crops. They will not take the trouble of inquiring into the cause themselves, nor will some of them, in all likelihood, when it is pointed out, do what is necessary to prevent a recurrence of the evil. The broad-cast system is so general, that people think it the best; and for my own part, I have seldom found, except among those who had been enlightened by education, any man who would admit that drilling wheat at intervals, such as he had never seen, could answer a good purpose; drilling is, to be sure, practised in many countries, but the grain is distributed in such large proportions, that I have doubts whether broad-casting has not been found better; when I propose, therefore, to plant wheat in drills, my intention is to give it sufficient room in the space between each plant to spread its roots and derive nourishment from the soil, as well as have open unconfined air. I also propose to leave space sufficient for the purpose of giving fresh earth to the growing plant, a consideration of great importance to its growth

and maturity. But as different soils are, by nature, more or less adapted to produce a strong and vigorous plant of wheat, it will be necessary for farmers who occupy light lands to make up their deficiency either by a little more seed or by greater care and superior management in giving solidity to the surface, and supplying the growing plant with due nourishment and fresh earth.

To drill wheat properly it should be sown in rows, twenty to thirty inches asunder, and four inches at least from plant to plant. The grain should be deposited deep enough in the ground to be covered and secured from the depredations of birds, &c. It should then be rolled so as to press the earth close together in the top; immediately afterwards the sheep ought to be driven over till it be well trodden together. As soon as the plant shews itself strong over the ground, it may be horse-hoed in order to cut up any weeds which may have begun vegetating. Should the land not have received the proper top dressing before, this will be good time to lay it on, and the first opportunity of dry frosty weather ought to be seized for that purpose; the horse and cart wheels can go along the furrows in such a way

as not to do any injury to the plant, and the man or men following may spread the dressing lightly and evenly over the whole. Should any weeds of consequence appear after the first horse-hoeing, that operation may be performed again with advantage; after which the intervals may be ploughed with a moulding plough, either double or single mould board, and the soil thrown up towards the plants so as to contribute both to their warmth and nourishment. The wheat may now be left until spring with every prospect of its doing well through the winter.

Early in March, or if the weather will permit, in February, the sheep should be driven over the wheat again, to press down the surface close about the young plants, and prevent the cold winds, the frost, and the sun from injuring the roots. As soon as the weeds begin to grow the plough should be sent in to take the earth away and cut them up, which operation repeated twice, will, it is to be hoped, effectually destroy them; then the moulding plough to throw the earth well up to the plant. These different operations should be finished before any injury could

be done to the crop by going on the land. The operations of horse-hoeing and the double mould plough will be found of very great benefit, not only to the wheat crop, but as a preparation for that which is intended to come after, leaving the ground in a clean and garden-like condition, and, by having destroyed the weeds, prevented them exhausting the land of that part of its fertility which the wheat did not consume.

It should not be considered expensive when the value conferred on the crop and the land shall be taken into the account; because, if the weeds thus destroyed had been suffered to remain in the earth, casting their seed and vegetating every season, it would not only be an annual expense to have them pulled, but they would be still farther injurious and likewise expensive in occupying the place of corn, and exhausting the nutritive powers of the soil.

Land thus treated would be better than after a naked summer fallow, in good heart and clear of weeds, an object to the occupier of first-rate consequence, besides the superior value of his wheat crop, which will have been increased in a proportion greatly to exceed the trifling expense

bestowed upon it, though that expense must have been partly incurred by hand-weeding, except in cases where the occupier considered the money paid for weeding as altogether thrown away, an idea by no means uncommon.

There are, moreover, other benefits to be derived from the drill system practised in this way, which I shall enumerate, to recommend it more strongly to my readers.

The utmost art, ingenuity, and industry, used in the preparation of land, will be exerted in vain, unless the seed be deposited in the ground, in such a way as that the roots can have sufficient room to grow; because, if they should be prevented establishing themselves in the soil so as to contribute all that is required of them to the support of the plant, it is not possible that the crop can be good; but must be injured in some shape or other, which according to the season or nature of the land, will shew itself either in the form of smut, rust, blight, or mildew. Each root of a wheat-stool requires a space in which it can spread *free and unmolested* by *the intrusion of any other matter*, whether the roots of wheat itself, of weeds, of grass, or

even of vegetable matter ploughed in and imperfectly rotted, of long dung, which is too frequently made use of by slovenly farmers and bailiffs, who are in the habit of calling straw by the name of dung or muck, and frequently injure the finest lands by its application; in short, any of those things are inimical to the growth of the roots of wheat; the proper understanding of which rule of nature would save many occupiers of land from an improper mode of management; and it is further illustrative of that agricultural axiom which I have laid down in this work, *that those diseases which do so much injury to our wheat crops, under the name of smut, rust, blight, and mildew, arise either from the soil not possessing the ingredients necessary to mature and perfectly form a grain of wheat, or from the plant, whilst growing, being deficient of those physical powers which would enable it to extract from the soil, and convert to its own support those ingredients necessary for perfecting its growth.*

That one very principal cause of bad crops and disease in wheat arises from the seed being improperly sown, I assume as a law of nature

universally acted upon, and not from any capricious unaccountable proceedings in the seasons, the intervention of electricity, or the influence of the stars. That hurricanes or unusual convulsions of nature have frequently removed mountains and destroyed towns and villages, we know; that lightning has shivered in pieces huge oaks and dispersed large trees like chaff, is beyond a doubt; but these are by no means regular or daily occurrences; they may be considered as loud sounds of the omnipotent voice, rather than his usual mode of speaking; a single oak is more frequently destroyed than entire forests, and I confess I have never yet been able to trace the actual progress of electricity in a field of wheat which has been injured by smut, rust, blight, or mildew; the operations of lightning are seldom so gentle; they bear a much more marked character.

I am the more anxious to expose the weakness of imputing the diseases of wheat to causes over which we cannot possibly have any controul; because the very idea of it being impossible to guard against the evil, will prevent farmers from attempting to do so; and I consider the right

understanding of the origin of any disease as a step towards prevention or cure; it is particularly so in the case of wheat, because every occupier of land has the means abundantly in his power.

To those who are in the daily practice of viewing the operations of nature with a careless inattentive eye, it may be considered matter of fanciful speculation to say, that any real difference can arise to a crop of wheat from the circumstance of the seed being sown in regular rows or broad-cast; but the fact is unquestionable. When sown broad-cast, the roots interfere, cross each other, and prevent regular growth, from which proceeds inferior crops and diseases of various kinds, with abundance of weeds in many cases, as it frequently is found impossible to send people into the field to destroy them, without also destroying the corn. There is one circumstance particularly necessary to be observed relative to broad-cast sowing, that when the crop comes up remarkably thick, the injury done by the roots interfering with each other is not the only one which the wheat sustains; as in this case the great closeness of the straw or haulm

prevents the access and free circulation of the sun and air, both of which are powerful and indispensable agents in bringing corn to maturity, and without them no crop of grain can either fill or ripen; therefore those who are of opinion that a bulky crop must be profitable, or that every interval of soil which is not filled up with the plant will be of course so much lost, are decidedly wrong, and although they may not give credit to this doctrine, every day's experience will prove it to be correct; and as to the question of thick or thin sowing upon land in general, it may be necessary to observe, that where the soil is replete with the proper nourishment or food for wheat, the roots will not travel so far, or extend themselves, in search of that food, as they will in land which is in a poor state, of which law of nature farmers ought to be previously acquainted.

I am by no means so sanguine as to suppose that any exertions of mine will be of sufficient consequence to make one proselyte to the drill system, therefore I have endeavoured to give such instructions as will be useful to the growers of wheat, both drill and broad-cast; and one caution

appears to me to be particularly necessary to broad-cast cultivators, which is *to plough in their seed in lands of all descriptions* on which it can be done; of course I am to be understood as recommending it not to be buried too deep. When the seed is ploughed in, and the land directly afterwards rolled and trodden with sheep, there are twenty chances to one that the crop will be a good one. On light lands, however, which the frost is apt to heave or puff up, so as to throw the seed out of the ground or admit the cold winds in spring, ploughing in the seed is absolutely necessary, and heavy rolling as well as treading, by no means to be neglected.

As one of the most material points in wheat management is to provide the roots with a dry, warm seed bed, and guard them from the attacks of sharp winds, or, indeed, any vicissitudes whatever, the drill system is deserving of every attention, as calculated above all others to accomplish the object. The expert cultivator can, on lands of all descriptions, and in the wettest or coldest seasons, manage to lay his wheat both warm and dry by the simple operation of throwing up the earth in the intervals between the rows to

the corn after it shall have shewn itself pretty strong over the ground; this will keep the wheat warm and convert each space between the rows into a complete water furrow.

It is well known to those farmers who occupy land very retentive of moisture, and consequently apt to hold surface water, that corn and grasses cannot thrive so long as they are incommoded by a superabundance of wet, and that the first object towards securing a crop is *to lay the land dry*. It is also well known to the same men, that no quantity of dung, nor, indeed, any fertilizing compost whatever, will be of sufficient efficacy to counteract the bad effects of the extra moisture. This being granted, I would beg my reader to hold it in recollection, as an axiom in agriculture; and by extending the inquiry, he will find that in lands and seasons where the growing wheat shall have its roots continually drenched with rain, without any interval of time to dry them, such wheat must woefully disappoint the hopes and expectations of the grower, even though he should have bestowed all the pains which skill, industry, and capital, had enabled him to do on the previous preparation of the land;

but this might, perhaps, prove an aggravation of his loss.

In vain he will endeavour to account for the injury done to his crop, except by attributing it to the wet season; and as he cannot possibly have any controul over the weather, vain and hopeless would it appear to him to think of counteracting the decrees of omnipotence.

But by attentively examining the merits of the case, and giving it due consideration, we shall be able to find a mode of management, which, at the same time that it is simple in itself and possesses many other great recommendations, will completely and effectually guard against the injury which wheat crops have been found to sustain in seasons when rain has fallen unusually abundant in the spring and summer, as was the case last year, (1811.)

This method then is no other than sowing the seed in drills, and afterwards using the moulding or horse-hoeing plough, as herein pointed out.

Drilling, as generally performed, is a very imperfect and slovenly operation, from which the farmer never derives the advantages he ought, and seldom those he may expect. On this

account I am by no means surprised that the practice has not extended itself more, whilst if its real benefits were known and experienced, the surprise would be to find any grower of wheat who would then persevere in the broad-cast system; and it certainly is a very sufficient apology for those who are tardy in adopting what we are in the habit of calling improvements in agriculture, *that the practice has not been found to answer the expectations held out;* a result that very frequently attends systems intrinsically good, but, which, from some capital omission or other imperfection in the practice, have been found by no means worthy of general adoption. This is particularly the case with respect to drill husbandry; for if the seed shall be deposited too thick in the rows, and the drills formed too close together, as is very generally the case, the broad-cast method is much to be preferred. The roots in the drills coming up in clusters interfere with each other's growth, and frequently cause the crops to be abundant in straw but deficient in both quantity as well as quality of grain; whilst in that sown broad-cast it is by no means so frequent for a number of grains to fall together.

The practice of sowing in drills may, therefore, be considered as good or bad according as it shall be well or judiciously conducted or otherways. It is to be observed that the plants must be allowed sufficient room for their roots to grow independent of each other, and to tillow or grow into a cluster; for if set too thick it is in vain to expect a full crop. The farmer should likewise keep in recollection that sowing thick or thin must be regulated by the quality and condition of the land, as well as the goodness of the seed; attention must likewise be paid to the season of sowing.

Wheat, in some description of soil, will tillow and spread into clusters before the winter; consequently one peck of seed may be calculated to go as far in seeding such ground as two where the plant comes up singly and does not spread so luxuriantly. When land of this description is in a state of fertility, free from weeds, lying dry and suitable in other circumstances, it may be taken as a criterion to go by, *that a farmer can, by a proper mode of management, produce from sixty-four to eighty bushels of wheat, Winchester measure, on an acre.* This is a quantity so much

above the general average return of land, that in all likelihood many of my readers may entertain serious doubts of the thing being possible; but if any man should wish for an easy method of convincing himself on the question, let him take the following method:—Reckon the number of sheaves upon an acre; count then the number of straws in one sheaf, and supposing *every third straw* to carry a full-sized ear with the grains well-formed and plump, except the top and bottom, it will be by no means difficult to ascertain how many of those grains would fill a pint, and the transition to a bushel is a simple process, from thence to the entire contents of an acre.

The reason why I take only *every third straw* is because I calculate, that in drilling wheat, one third of the number of straws compared with the number grown broad-cast would be about the return; each straw would carry a large ear full of well-formed grain.

Farmers in general look at the bulk of straw in a growing crop and judge from thence what the produce is likely to turn out; but this is at best a very vague and uncertain guide.

When the straw happens to be remarkably long and thick, it is indicative of small produce in corn, and even that of inferior quality. This arises from a very natural cause, for as I have, in another place, shewn that *light, heat,* and the free access of *atmospheric air,* are indispensable in bringing grain to maturity; it follows, of course, that when the straw shall be so bulky as to exclude all these, the grain cannot be brought to fill or ripen; and, in short, smut is more generally found to prevail in very heavy crops than in those which are lighter and less promising to the eye.

In this season of high prices we have had many public-spirited men proposing plans for augmenting the quantity of human food, some by an increased growth of potatoes, others by the cultivation of waste lands, by inclosures, and, in short, by various methods which might certainly be adopted with considerable benefit to the public. All these suggestions are praise-worthy, and do credit to the authors; but, at the same time, extended cultivation is, by no means, so desirable an object as the adoption of an improvement which would enable us to produce double the quantity

of wheat on every acre to what we can at present. This would not call for more capital; every farmer, great and small, may do so if he shall think proper to make trial, and moreover the effects will be felt in their beneficial consequences to the public the very next season. I am an advocate for inclosures, but the improvement sought to be introduced by this treatise is more easily attainable, and, of course, more immediately an object.

A wise man frequently contrives to derive benefit from what people in general call misfortunes, making even calamities subservient to his comforts and convenience. Let us then, as a nation, follow such a laudable example, and by pursuing an improved method of wheat management, to which the present high price of bread, and the bad crops of last year, have, of necessity, driven us, render that what we now estimate as a misfortune, the means of guarding against its recurrence in future.

CHAPTER XII.

On the advantage of transplanting and dibbling wheat.

THE transplanting wheat has been frequently recommended, and like many other useful and valuable improvements, seems almost entirely given up.

But if the benefits to be derived from the practice were sufficiently known, there is little doubt that it would be much followed on some lands. Many people are deterred by the expense, many others by the trifling appearance of the operation. I have known an instance where a public-spirited landholder undertook to transplant in one farm fifty acres of wheat, drawing the plants from a bed into which they had been previously

pricked in the manner of cabbage plants from the seed bed. This operation was conducted by men and women who had been accustomed to garden work, and was executed in a workman-like manner; the plants being set out about five inches apart in the drills which were fourteen inches asunder, a moderately heavy roller going over the day's work as soon as finished. When the plants began to grow strong, a horse-hoe was sent between the rows to stir the surface and cut up any weeds beginning to rise; after which the double-mould plough was sent in to earth up and supply the wheat with fresh soil.

This crop was most abundant and profitable, which induced the owner to make a farther trial next season; but having, from an idea of economy, employed children, unacquainted with the process, the putting in of the plants was done in such a slovenly, imperfect manner, that there was a necessity for going over the field again, which not only created an extra expense, but caused great irregularity in the growth and ripening of the grain. The saving of seed was very considerable, as the quantity sown in the seed-bed was no more than at the rate of one peck

to the acre. When the plants had spread themselves, they were taken up, and the stools or clusters separated when they were pricked out, and afterwards taken up in clusters, separated, and planted out for a crop. The produce of the first year's trial was forty-four Winchester bushels per acre, E. M. The saving of seed was considerable, and much more than paid the expense of transplanting; besides, it was admitted that the *quality* of the grain was superior to what had been generally grown on that land, being plump and heavy. Such a practice as this of transplanting wheat would not only be of service in saving a great deal of grain, but must be considered a public benefit, as giving employment to such multitudes of hands, which would not be equal to the more laborious departments of farming work; and the principal difficulty in the way of the farmer would be the habits of idleness and insubordination which prevail amongst the children of the cottagers, arising chiefly from their parents preferring parish relief to the independent and honourable wages of industrious avocations.

In fact, I am prepared to prove, that the husbandry and rural occupations of Great Britain

would abundantly provide for that part of the population which is, at present, an almost intolerable burthen to the community. If any proper regulation could be universally adopted to set such a system going forward, there would be useful employment for all ages every season of the year.

However, this is too great a desideratum in improvements to be brought in by way of episode; and must be left to the efforts of those who can give it weight and consequence.

Want of regular occupation sends many useful hands from the country into towns and villages where manufactures and various other kinds of employment afford a livelihood. And yet the agriculture of this kingdom could employ every spare hand capable of working, if its operations were conducted as they ought to be; but, in justice to the great body of the farmers, it must be admitted that the difficulty of providing *proper servants* for each branch of husbandry is so great as to warrant the bringing to their aid every assistance which can be had from horses and machinery; and thus I think stands the account at present: if the occupier of land saves labour, he pays more to the parish, and vice

versa, if he pays something more to the parish than he did formerly, he saves it in the fewer hands he employs. But after all the saving of manual labour by improved implements, there is abundance of employment for those who are at present a burthen to the parish.

I have mentioned the difficulty of providing proper servants for *each branch* of husbandry, and that is greater than is usually admitted. The occupation or calling of a labourer is indefinite; some farmers certainly make a distinction in particular cases; but, as far as my observation has enabled me to go, I am clearly of opinion, that if men who live by the practice of agriculture were to endeavour to acquire a degree of excellence in one or two particular parts of the business on a farm, rural occupations would be conducted better in every way than they are at present. It must be clear to every capacity that a labouring man who knows thoroughly the business he shall be put to, can earn more wages and do his work much better than one who has it yet to learn. A farmer who employs promiscuously every person that offers, and puts them to all kinds of work, must find that he conducts

his operations on a more expensive and imperfect scale than he who selects and appoints his labourers to that species of employment at which they have attained superior cleverness by constant practice; he will have more satisfaction in seeing what goes on, when it is properly done, and not be under the necessity of finding fault on all occasions. Nothing would tend more effectually to introduce the custom of transplanting wheat than proper pains being taken to train up children to perform the operation properly and with care. Independent of providing them bread without resorting to the parish, it would accustom them to habits of industry, and by enabling them to earn an honest livelihood, wean them from practices which prevail too generally through the kingdom and lead to a system of depravity disgraceful to a people professing civilization; nor do I see why transplanting wheat should be considered as an operation too trifling for the attention of a farmer any more than transplanting cabbages; at first, to be sure, the children might find themselves rather awkward from its being new to them; but so it would be with any other business whatever; and when

the first attempt should be overcome, practice would soon render it familiar and easy to all, and those who were known to be particularly good planters ought to receive a reasonable encouragement.

There are some lands which, from their situation, must be very wet in rainy seasons for want of a proper fall for the water; wheat sown on them in the usual way would be perished, and frequently is so. In such cases I would, by all means recommend the cultivator to throw them into sharp ridges with the plough; after this let the light roll pass over the furrows length-ways to flatten the surface of the drills; the wheat should be put in on the tops when taken from the seed bed, exactly as cabbage plants are done, putting it three inches apart, and fifteen or sixteen inches in the rows; as soon as the operation of planting has been finished the light roller should be sent twice over the furrows length-ways to settle the soil close to the roots.

Dibbling wheat, which is very much practised in some parts of England, may be classed with the method of transplanting herein recommended; and as to their respective merits, however my

opinion may lean, I shall be cautious in deciding on the question.

In some soils and some seasons, according to the time of year, either custom may be found preferable at one time or another. In saving seed, employing the poor, and insuring excellent crops, they will both be found deserving of attention.

In recommending dibbling or transplanting, it must be held in remembrance, that the saving of seed is not the only benefit to be derived from the practice. When the seed or plant has been deposited a proper depth and distance, the danger of the roots interfering with each other, so as to prevent them fulfilling the functions required for the maturation of the grain, is guarded against, and there is a greater probability of a good crop; because, if the land shall have been previously in a good condition, and provided with the necessary materials, the roots will not travel so far in search of food as they would have to do in a soil of less fertility; it is, therefore, by no means, a fanciful or problematical point for the farmer's consideration, the benefits are unquestionable. There is no description of land where dibbling

would be found of greater benefit than those light soils which are liable to the attacks of frost, by which great injury is frequently done to the wheat crops in consequence of the plant being thrown entirely out of the earth, and totally spoiled; or if not thrown out the roots are so repeatedly disturbed that they never can take firm or fast hold of the ground, consequently they cannot perform their functions; hence diseased or scanty crops. On soils of this description harrowing in seed wheat is a practice but too common, and, in my opinion, is one principal cause why these lands are so often pronounced unfit for yielding wheat; their produce is very uncertain; indeed it must be so when proper precautions have not been taken by the cultivator to remedy the deficiency of the soil; precautions in themselves so very simple, that every man has it in his power to put them in practice.

My readers will, I hope, have seen throughout this work, that it has been my study to convey information rather than contend for any particular practice invented or chosen by myself. With this object in view, I have endeavoured to make

myself understood by those who follow the broad-cast system as well as the drill husbandry, and to every man perusing these pages I might truly say,—*Utrum horum mavis, accipe,—Take any method you choose,*—only observe, in the cultivation of wheat, that the seed requires a dry bed, a clean bed, a roomy bed, and a well-covered bed: all this has been pointed out in the course of the work now before us. If to these preparations, or rather precautions, be superadded suitable applications of fertilizing composts, including a proportion of lime long-slacked, chalk, marle, or lime-stone-gravel, I can venture to assure you, my reader, that there will not in future be any necessity for importing bread-corn from our enemies, nor shall we see the community suffering as they have done twice or thrice within twelve years from the extravagant price of bread. The lands *at present appropriated to wheat culture* would be sufficient to furnish that quantity which we import, provided they were judiciously cultivated.

Should the agricultural spirit of the nation be roused to greater exertions, inclosing and cultivating waste lands may be prosecuted with every prospect of success; but, as I have already said,

the evil we now complain of requires a more immediate cure than can be expected from remote proceedings.

There is a great deal of matter connected with the subject of wheat culture, which I have not had time to introduce in this work, having been arrested, when arrived at this part, by one of those domestic calamities which the most stern and rigid philosophy, with all its pride, must yield to, and before which, stoicism itself would be compelled to bow: it must, therefore, form a second volume.

I am in hopes what has been here stated may engage the attention of those into whose hands the guardianship of this mighty empire is entrusted; because there are many material and important points belonging to the great question of internal supply, which are of too much consequence to be brought in sideways, and

made to form only part of an essay, when, in point of fact, they are in themselves deserving of the most serious notice, and ought to form a separate subject of legislative consideration in a country like this, where the power and the will so eminently exist.

In the mean time, having taken a position of such vital importance to the welfare of the community, it is my determination to defend the same by every concurrent addition of strength; and in pursuance of this plan I will pay most marked attention to every proper application, accompanied by respectable signatures, through that very useful publication the Farmers' Journal, as well as the Printers of this Work, (free of expense) and give every explanation as well as assistance in my power to those who sincerely and truly wish to promote the object of this treatise, by extending and improving the culture of wheat on British lands,

preventing the necessity of importation in future, and guarding against scarcity or high prices.

I have seen, with particular pleasure, the marked attention paid by many public-spirited individuals among the farming body of Great Britain and Ireland to every species of *real improvement*, and from having witnessed such patriotic conduct on occasions of minor importance, it is natural for me to anticipate similar exertions where the improvement intended is beyond any thing yet treated of in agriculture, as to its weight in the great scale of national welfare.

I am well aware no literary treatise could convey every particular necessary to be known on this comprehensive subject, and therefore it is my determination, as above stated, to afford all the further explanation which may be sought for, by those who ask it from a motive unconnected with the disposition many people

have to amuse themselves with endeavouring to turn into ridicule that which they are not willing to understand.

Let me not be mistaken as arrogating any very extraordinary degree of merit for the matter contained in this essay; *it has been my particular study;* and we well know, that talents of mediocrity, devoted to almost any subject, are capable at least of throwing some light on the same.

FINIS.

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ERRATA.

Page 168, eighth line from the bottom, *for* tills *read* tells.

—— 197, fourth line from the bottom, *for* shift *read* shifts.

TREATISE
ON
WHEAT

LOUDON